DISEASE AND DEATH AMONGST THE NORTHERN KIKUYU

being

A study of the morbidity and mortality of
the South Nyeri District of Kenya Colony
during the decade
1944 to 1953.

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A thesis
submitted for the degree of Doctor of Medicine
by

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PREFACE

This study is an attempt to set forth the extent and causation of disease and death as seen amongst the northern section of the Kikuyu tribe of East Africa. It consists of an analysis of figures and information obtained in the course of routine medical practice in the hospitals and dispensaries of the three medical agencies at work in the South Nyeri District which is the northernmost district of the Kikuyu country. The period covered by the study is the ten years from 1944 to 1953.

The thesis is divided into three main parts. The first part consists of three sections of introductory material. The second part is composed of two sections in which the morbidity of the district is analysed. The first section of this part is concerned with the total figures of sickness (excluding maternity) seen at all the medical stations in the district during the ten years. The second section is an analysis of the morbidity by diseases (including maternity) derived from the experience of one of the three hospitals of the district, namely Tumutumu Hospital. The third and final part of the thesis considers the incidence and causation of the deaths which occurred in all the three hospitals of the district during the decade under review.

The period of this review was chiefly determined by

the availability of medical records. Unfortunately no local medical records prior to the year 1944 exist in the offices of the Medical Department at Nyeri, and this determined the year in which our study could begin. Also the case records of Tumutumu Hospital are not complete before the year 1942. The destruction of such valuable statistical material is a matter for regret.

My own experience of medical work in South Nyeri District is confined to the years 1947, and 1951 to 1955. During these years I worked at Tumutumu Hospital which, along with its associated dispensaries, is run by the Church of Scotland Mission.

The following abbreviations are used to denote the three medical agencies at work in the district:

G.M.D. = Government Medical Department.
C.S.M. = Church of Scotland Mission.
C.C.M. = Consolata Catholic Mission.

The hospital of the Roman Catholic Mission is variously known as the Consolata Hospital and Mathari Hospital. The latter name should not be confused with that of the Mathari Mental Hospital of the Government Medical Department in Nairobi.

The age and disease categories used in this thesis are those of the Sixth Revision of the International Statistical Classification of Diseases, Injuries and Causes of Death (1948).

SECTION I. THE EAST AFRICAN BACKGROUND.

1. Introduction.

2. East Africa and its invaders.

3. The Bantu and the Kikuyu.

INTRODUCTION

So geographers, in Afric maps,
With savage pictures fill their gaps;
And o'er unhabitable downs
Place elephants for want of towns.
"On Poetry",
Jonathan Swift.

AFRICA has been the victim of its own geography in its relationship with the rest of the world. For long it remained the Dark Continent with its interior cut off from communication with the outside world by a barrier of desert or tropical forest, which was broken only by the beds of unnavigable rivers. It is now little over a century since the first European explorers boldly entered the unknown interior to search for the sources of the mighty rivers which flowed from its heart to the sea. After them came the administrators, and soon in the Scramble for Africa the different territories were appropriated in various forms and for various reasons by the Powers of Europe. One result of this is that to-day, geographers are no longer in the position they were in 1773 when Dean Swift wrote the satire from which the above quotation is taken. Maps, though of varying degrees of accuracy it is true, are now available for most parts of the African continent. Its geographical features are now revealed for all to see as the result of the patient work of several generations of travellers and geographers.

It is far otherwise with the study of the geography

of disease in Africa. As recently as 1942, Lewis could say that "in Africa very little is known about many diseases among the bulk of the Negroes, and it is often impossible to state whether or not some diseases even exist there, much less to give rates of incidence." Yet the study of the distribution and incidence of disease is of vital importance to Africa, and to the world. There are at least three cogent reasons why we should study the geography of disease in Africa.

First of all, that we may know what diseases actually exist in Africa. We are still very ignorant of the incidence of disease in most areas of Africa. Many diseases which were at first believed not to occur there have been found to be not uncommon and even to be endemic, such as enteric fever. Stannus in 1923 said that "if you look for a disease in Africa you will find it. When I first went to Africa, I was told that certain diseases did not occur, but it only wanted a little investigation to find the cases." Certainly, in my brief experience of African diseases, I have learned that in the present state of our knowledge it is most unsafe to say that any disease <u>never</u> occurs in Africa.

A second reason for our study of disease in Africa is that we might find out how much of such disease can be prevented. Many of the diseases of Africa can be controlled and prevented, but it is only by patient investigation of the extent of their distribution and of the mode of their transmission, that we can discover how they may be prevented. This, surely, is the most

compelling reason for extending our knowledge of African diseases, that we might be able to relieve some of the suffering that they cause.

The third reason why our study of the diseases of Africa is important, is that by such study we may be able to discover possible aetiological influences which determine the incidence of certain diseases. There are diseases which though common in Europe, are uncommon in Africa. The so-called diseases of civilisation, such as essential hypertension, coronary thrombosis, peptic ulceration and thyrotoxicosis, provide a pertinent example of such diseases. Study of the factors which may control the difference in incidence of these diseases on the two continents may throw some light on their causation.

The study of disease in Africa, however, is not always easy. The difficulties of travel in a land with few railways and few first-grade roads are only the initial trials which have to be overcome. In many parts of the continent, it is still true that if you are to meet the people whose diseases you wish to study, you will need to travel on foot and use porters to carry your baggage. Even when you have arrived in the district you wish to study, you are still faced with the African mind which has not yet changed much from its habits of a century or more ago. The people show an irritating lack of interest in the diseases which afflict them. They do not argue from cause to effect in determining their origin, but prefer to accept the word

of the medicine man. In many districts, medical facilities are very primitive, and diagnostic techniques are necessarily of the simplest. Though the study of disease in Africa is not easy, it is well worthwhile, and the investigator can find satisfaction in the fact that, in however humble a way, he is following in the footsteps of Sydenham and Mackenzie in describing and observing the diseases of Africa. He is doing for Africa what they and many others did for Britain. He is adding to the sum of medical knowledge, and at the same time contributing to the well-being of the peoples of Africa.

EAST AFRICA AND ITS INVADERS

The history of East Africa resembles that of most parts of Africa. The coastal area has a long and well-recorded history, whilst the certain history of the interior dates from only recent times, and may be said to begin about the year 1850.

From prehistoric times the Arabs from Oman and the Hadramaut traded along the East African coast. After the year A.D. 700 they began to found settlements on the coast in places where they could find suitable anchorages for their dhows. Their only interest was trade, and their exports from East Africa to Arabia were chiefly of slaves and ivory. They plied their trade undisturbed until the sixteenth century when the Portuguese obtained control of the Arab settlements for almost two centuries. In the year 1698, however, the Arabs regained control, and the Portuguese were defeated, and their influence on East Africa north of Cape Delgado waned. To-day there is little trace of their occupation of the East African coast apart from Fort Jesus at Mombasa. In 1840 the Sultan of Oman transferred his court from Muscat on the Gulf of Oman to the island of Zanzibar, and from that time Arab influence increased throughout East Africa and to the great lakes and even beyond.

The penetration of the interior and its opening up under European influence began in the year 1844 when Dr Ludwig Krapf founded a mission station at Rabai near

Mombasa for the Church Missionary Society. In 1851 he reached the border of the Kikuyu country, and was followed by others, both missionaries and explorers. In 1886 the area now known as Kenya Colony came under British influence completely, whilst the Germans appropriated the area to the south, later to be called Tanganyika. By this time the main geographical features of Kenya were known, but European and missionary influence was still mainly confined to the coastal belt. The opening up of the interior of British East Africa was due principally to the Imperial British East Africa Company which was granted a charter in 1888. Its first up-country station was opened at Machakos in the Kamba country in 1892, and from here trading posts were opened throughout the country. To Machakos in 1895 came the first Indian traders to settle in the interior, and they were but the forerunners of the Indian traders who are now to be found all over Kenya. Also in 1895 the Company relinquished its charter and a British Protectorate was declared over British East Africa. Between the years 1895 and 1902 the Kenya and Uganda Railway was built from Mombasa to Uganda, and hundreds of Indian coolies were brought from India to help in its construction. Between 1900 and 1920 the Colony gradually acquired its present character. British settlers took up land for farms. The Indians opened shops in every corner of the land, and the foundations of a political structure for the Colony came into being.

When we pass to consider the origins of the African

peoples of the interior we step behind the curtain of prehistory into darkness and uncertainty. The most generally accepted theory of the origin of the peoples of the interior regards them as having been derived over a period of many thousands of years from three main stocks: the aboriginal or Bushmanoid, the Negroid and the Hamitic. The aboriginal or Bushmanoid stock were represented by a light-skinned people who lived by hunting and food-gathering. It is probable that they entered Africa from the north and then spread southward over the whole continent. Most South African scholars, however, believe that they originated in South Africa and then migrated northwards(Cole, 1954). They hardly exist in Kenya to-day, but may be represented by the Ndorobo tribe. The next invasion of East Africa was by a Negroid people who appear to have originated in Western Asia. They were characterised by the facial and other appearances which we regard as typical of the Negro to-day. After many millenia they were followed by the proto-Hamites, a light-coloured, non-Negroid people of Caucasian origin. They conquered the Negroid peoples and then intermarried with them to produce the Bantu peoples, who are of mixed Negroid and Caucasian origin. More recently came the true Hamitic peoples. The first wave of invasion was absorbed by the Bantu people. The second wave came down the Nile and remained in Kenya as the Luo tribe, the main Nilotic tribe of Kenya. Finally, in quite recent times the half-Hamitic Masai tribe pushed down from the

north into Kenya to settle astride the future boundary between British and German East Africa. The details of the picture are still controversial, but the main outline is clear. East Africa, in common with the rest of the African continent, was populated by successive waves of immigrants who swept down the land from the north or north-east(Seligman,1930).

We are chiefly interested here in the medical history of Kenya, and it is of value for our subsequent discussion to analyse the different racial invasions of the land. This may help us to determine the diseases which may have been introduced to Kenya by immigrant peoples. It is realised that any such conclusions can be conjectural only, since absolute proof would be impossible to produce. Thus we may analyse the racial invasions of Kenya as follows:

I. FROM THE NORTH OR NORTH-EAST:

1. The aboriginal or Bushmanoid peoples.
2. The Negroid peoples from Western Asia.
3. The Caucasians or proto-Hamites.
4. The Hamites:
   a. From the north-east.
   b. From the Nile valley(the Nilotics).
   c. From the north(the Masai)

II. FROM THE COAST:

1. The Semites or Arabs from Arabia.
2. The Aryans:
   a. The Portuguese
   b. The British from the mid-nineteenth century.
   c. The Indians(mainly Gujeratis).

THE BANTU AND THE KIKUYU PEOPLE

It is generally believed that the Bantu peoples were the result of the intermingling of the proto-Hamitic invaders and the Negroid inhabitants they found in possession of the land. To-day they are found in every corner of Africa south of the Sahara. They are defined as a people, not ethnologically, but linguistically. The Bantu peoples are composed of those tribes which use some form of the root -ntu to denote a human being, and whose language is characterised by the law of alliterative concord. By this law the prefixes of all the words of a sentence are determined by the prefix of the subject noun.

The Bantu peoples are divided into three main geographical groups - the Eastern, the Western and the Southern. The Western and the Southern groups are the larger and more important, but the Kikuyu tribe belongs to the Eastern group. The Kikuyu form one of the most important tribes of the north-eastern division of the Eastern Bantu. They are generally believed to have migrated from the region north of the River Tana, perhaps from Somalia, and they settled on their present tribal lands over the past five centuries(Lambert,1950). They came in successive waves and reached the area of Fort Hall about 1550 according to Lambert. Fort Hall lies in the centre of Kikuyuland, and from here they moved south into Kiambu district which they occupied about the year 1800, and north into Nyeri district which they

appear to have occupied about the same time. Routledge in 1910 working in Nyeri district was able to find some old men who could still remember the time when the tribe was advancing westwards towards the Aberdare Mountains at the rate of about ten to fifteen miles each year, felling the trees of the forest as they went.

The derivation of the name Kikuyu is uncertain. The most probable source is from the root -kuyu, which is used in the word mukuyu, which is a species of wild fig. Routledge(1910) derives it from this root and construes it as consisting of a locative prefix ki and the root -kuyu. The name can then be translated as "the country of the wild fig trees". Kenyatta(1938) accepts this derivation and points out that in Kikuyu tradition the mukuyu tree was the one at whose base God ordered the parents of the tribe to sacrifice. If this derivation is accepted, then it follows that the name applied originally to the land occupied by the tribe, and then was applied to the tribe later. There is an ambiguity in the modern usage of the name. It may be used of the Kikuyu people properly so called, and this is its usage in this study. It may also be used to include the two closely related tribes of the Embu and the Meru along with the Kikuyu proper, and this is the sense in which Kenyatta(1938) uses it in his book.

The Kikuyu tribe is one of the largest tribes in Modern Kenya, and forms about twenty per cent. of the African population of the Colony. More than a quarter of the tribe have migrated from their tribal lands to

other parts of Kenya, especially to the coastal area and the European settled areas which lie to the north-west of Kikuyu country. Table I gives an analysis of the total Kikuyu population of Kenya Colony in 1948, which was the last year in which a census was taken. The figures are given in the East African Economic and Statistical Bulletin(1951).

DISTRICT	MALES	FEMALES	TOTAL	PERCENTAGE LIVING IN DISTRICT OF ORIGIN.
Kiambu	199,853	188,309	388,162	65
Fort Hall	188,542	196,309	384,851	78
Nyeri	124,613	128,715	253,328	71
TOTAL	513,008	513,333	1,026,341	AV. 71

Table I. Total Kikuyu population of Kenya Colony.

The Kikuyu occupy an area which lies to the south and south-west of Mount Kenya. This area is roughly 1,200 square miles in extent, and supports a population of about 750,000 people. Kikuyuland is divided into three administrative districts. These are Kiambu, Fort Hall, and South Nyeri. Kiambu District is the most southerly and reaches to the outskirts of Nairobi, the capital city of Kenya. Fort Hall District which is the largest lies between the other two. South Nyeri District is the most northerly of the districts and it is this district with which we are concerned in our study. Table

II gives the area of each district and the density of the population according to the census of 1948. The area is exclusive of public grazing land and the forest reserves.

DISTRICT	AREA (sq. miles)	POPULATION DENSITY (per sq. mile)
Kiambu	324	777
Fort Hall	583	515
Nyeri	336	536
TOTAL	1,243	AVER. 609

Table II. Area and population density of Kikuyuland.

The situation of the area of Kenya Colony occupied by the Kikuyu tribe is shown in the map which forms Figure 1.

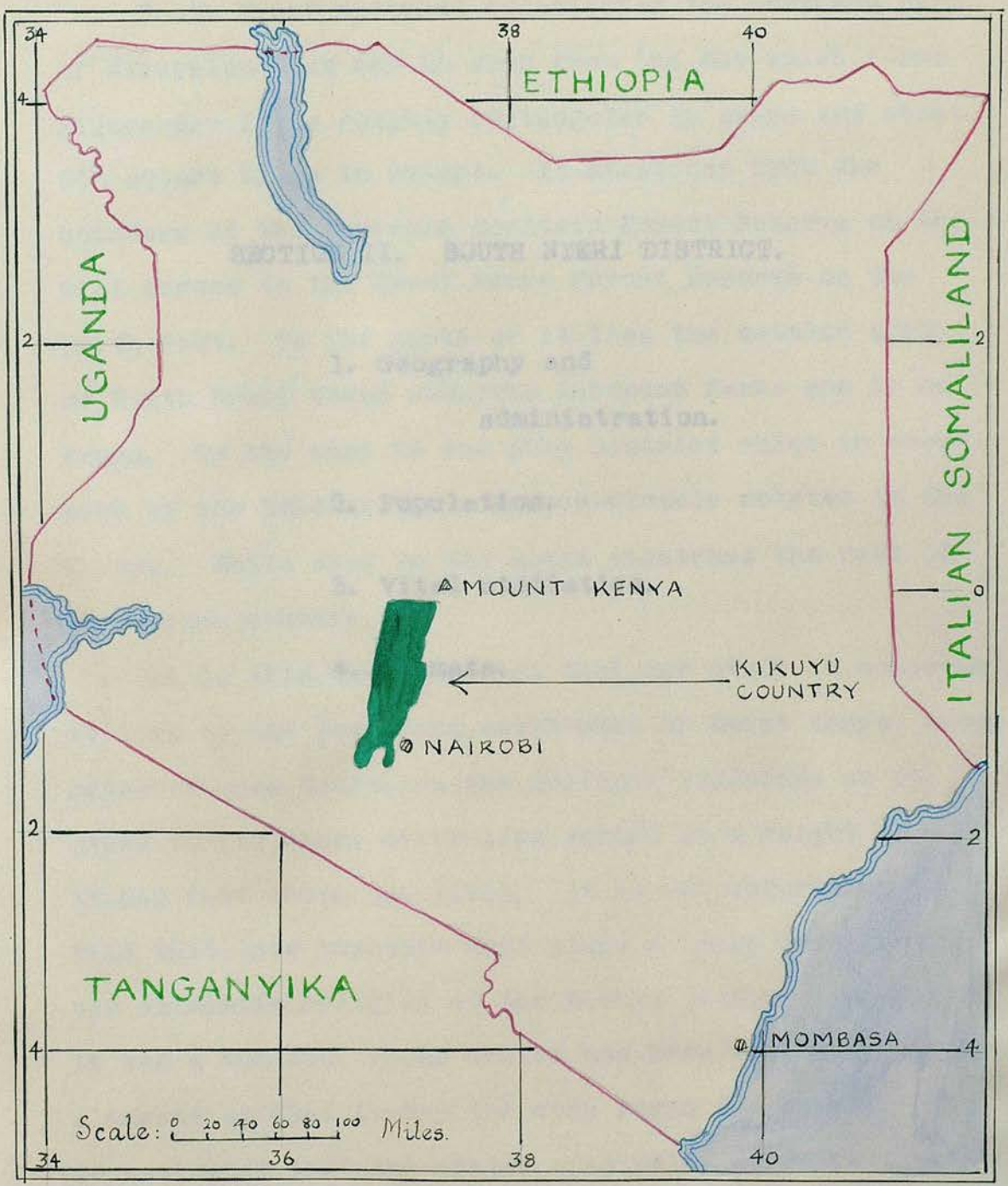


FIG. 1. THE SITUATION OF KIKUYU COUNTRY IN KENYA COLONY.

SECTION II. SOUTH NYERI DISTRICT.

1. Geography and administration.

2. Population.

3. Vital statistics.

4. Climate.

SOUTH NYERI DISTRICT

South Nyeri District constitutes the northern part of Kikuyuland, as can be seen from the map which forms Figure 2. It is roughly rectangular in shape and about 336 square miles in extent. It stretches from the boundary of the Aberdare Mountain Forest Reserve on the west across to the Mount Kenya Forest Reserve on the north-east. To the north of it lies the settled area of North Nyeri where numerous European farms are to be found. To the east is the Embu District which is occupied by the Embu tribe, a people closely related to the Kikuyu. While away to the south stretches the rest of the Kikuyu country.

It is with this district that our study is concerned. It lies to the south and south-west of Mount Kenya, whose majestic mass dominates the northern landscape as it rises to its sharp mitre-like summit at a height of 17,040 feet above sea level. It is not surprising to find that this mountain mass plays a large part in the old animistic religion of the Kikuyu people. In origin it was a volcano, whose crater has been worn away by the elements so that to-day the cone forms the summit. It is estimated that the crater originally stood at least 3,000 feet higher than the present mountain summit. The soil of the district is volcanic in origin. The topsoil now survives only in the forest areas as a shallow brown loam. In the rest of the district, the topsoil has long since been removed by the action of wind and rain, and

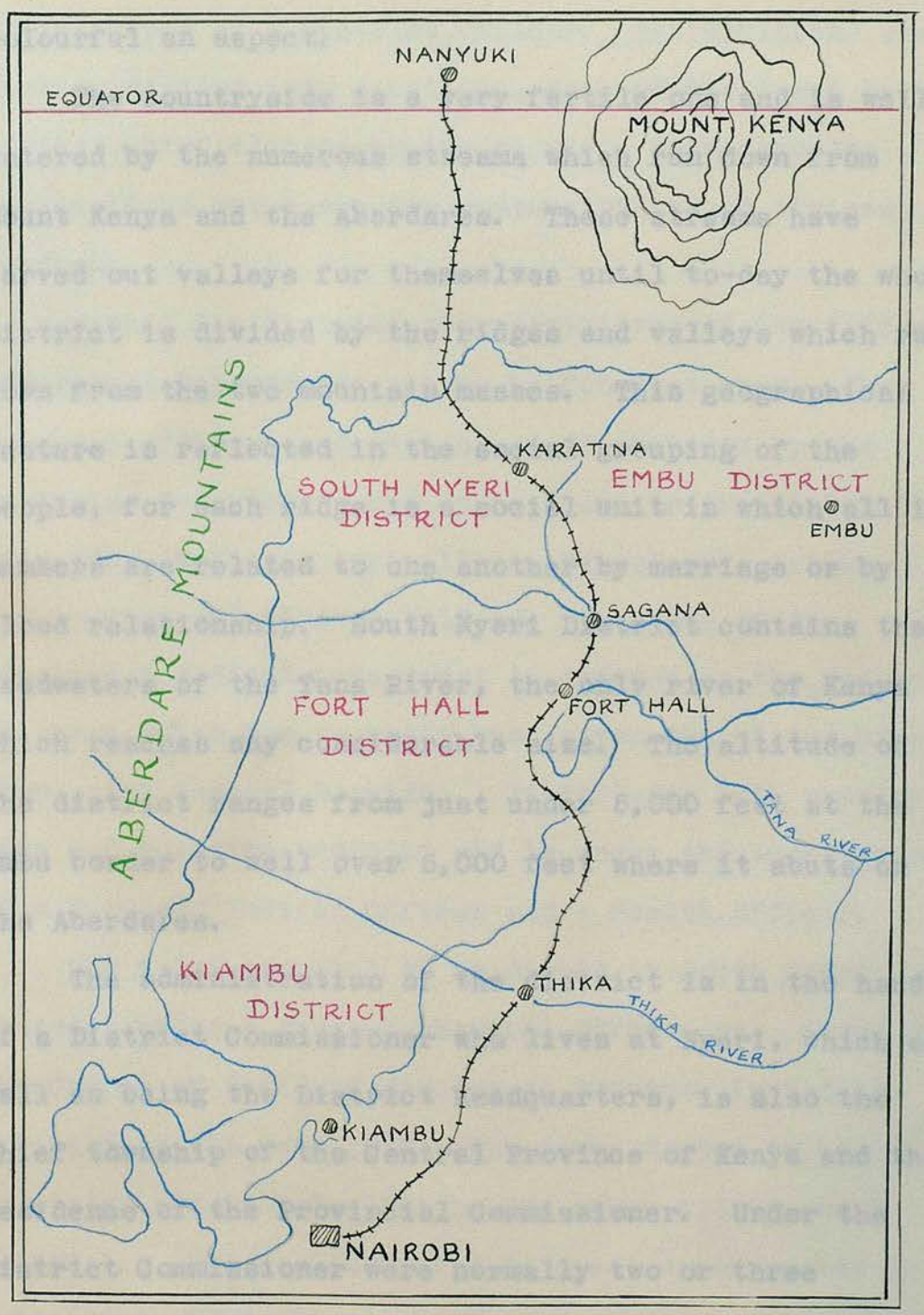


FIG. 2 THE KIKUYU LANDS.

this has exposed the reddish-brown laterite of the deeper soil, which now provides so pleasing a contrast with the green vegetation and gives the Kikuyu landscape so colourful an aspect.

The countryside is a very fertile one and is well-watered by the numerous streams which run down from Mount Kenya and the Aberdares. These streams have carved out valleys for themselves until to-day the whole district is divided by the ridges and valleys which run down from the two mountain masses. This geographical feature is reflected in the social grouping of the people, for each ridge is a social unit in which all its members are related to one another by marriage or by blood relationship. South Nyeri District contains the headwaters of the Tana River, the only river of Kenya which reaches any considerable size. The altitude of the district ranges from just under 5,000 feet at the Embu border to well over 6,000 feet where it abuts on the Aberdares.

The administration of the district is in the hands of a District Commissioner who lives at Nyeri, which as well as being the District Headquarters, is also the chief township of the Central Province of Kenya and the residence of the Provincial Commissioner. Under the District Commissioner were normally two or three District Officers, but the number of these officers has been greatly increased since the State of Emergency was declared in October, 1952, and it is likely that the increase will continue under the new policy of closer

administration of the African Reserves. The district is divided into four divisions whose names are North and South Tetu, Othaya and Mathira. Each division is now administered by a District Officer. The divisions are further divided into locations, each administered by an African chief elected by the people. Then come the sublocations which are the responsibility of African headmen.

Within the district, representatives of the different Government Departments are to be found at work. Thus European officers and African staff employed by the following Departments are to be found in the district: Education, Medical, Agriculture, Veterinary, Labour, Information and African Welfare. The work of the Government Medical Department is centred on the Hospital in Nyeri which has recently been given the status of a Provincial General Hospital. It includes both preventive and curative medicine and is under the supervision of a European Medical Officer and a Health Officer.

The first hospital to be opened in South Nyeri District under a European Medical Officer was opened by the Church of Scotland Mission at Tumutumu in Mathira Division in the year 1910. The first doctor to be appointed was Dr H.R.A.Philp. He began with a small dispensary, but was soon able to erect a corrugated iron building to house his patients and an operating theatre. This building still stands to-day and is used as the male ward of the present hospital. Because of the shortage of Government Medical Officers, Dr Philp was

called upon to act as the Senior Medical Officer of the Kenia Province for a number of years in addition to his duties at Tumutumu. Gradually he established thoughout the district a system of dispensaries. Some of these grew out of the emergency medical stations he established during the influenza pandemic of 1918, whilst others were set up at the request of the local people who had come to value the services of European medicine. Some of these dispensaries were later handed over to the Medical Department for their administration. Two examples of such were Mihuti and Karatina Dispensaries.

The first year in which the name of Nyeri appears in the Annual Report of the Medical Department is 1913. In that year a dispensary was established in Nyeri Township for the treatment of Government employees only. It was in charge of an Indian sub-assistant surgeon and was said to have been erected on the site of a former quarantine station which had been set up to deal with the epidemic of cerebrospinal meningitis which had swept through the district earlier in 1913. The dispensary continued until 1922 when it was closed as part of a policy of retrenchment due to financial stringency. It was re-opened in April, 1923 and was now supervised by the Government Medical Officer at Fort Hall, which was regarded as the provincial centre at that time. In 1929 the first hospital under a Government Medical Officer was built at Kerugoya and provided with thirty beds and two sisters. Kerugoya was at that time in the South Nyeri District, but it is

now in the Embu District. In 1932 some permanent buildings were erected at Nyeri and its capacity was increased to thirty beds. Meantime the provincial centre had been moved to Nyeri, and so the hospital there was under the direct supervision of the Senior Medical Officer. This arrangement continued until 1943 when the first medical officer was appointed to take charge of the medical work in South Nyeri District.

The medical work of the Consolata Catholic Mission began with the establishment of a small dispensary at the head station of Mathari, about two miles out of Nyeri Township. This was followed by the setting up of other dispensaries at the other mission stations they established in the district. These were in charge of Italian sisters. In 1939 the first hospital buildings were put up at Mathari, and an Italian doctor was appointed. With the outbreak of the Second World War in 1939 the doctor and the sisters were interned and the medical work remained in abeyance. In 1946 the doctor was released from internment and with his return the hospital was re-opened towards the end of the year. From this time too, the work of the dispensaries was re-established in the district.

To-day there are these three agencies with active medical work in South Nyeri District. Each has a hospital and a dispensary system based on that hospital. Table III summarises the medical facilities of the three agencies, whilst their distribution throughout the district is given in Table IV and Figure 3.

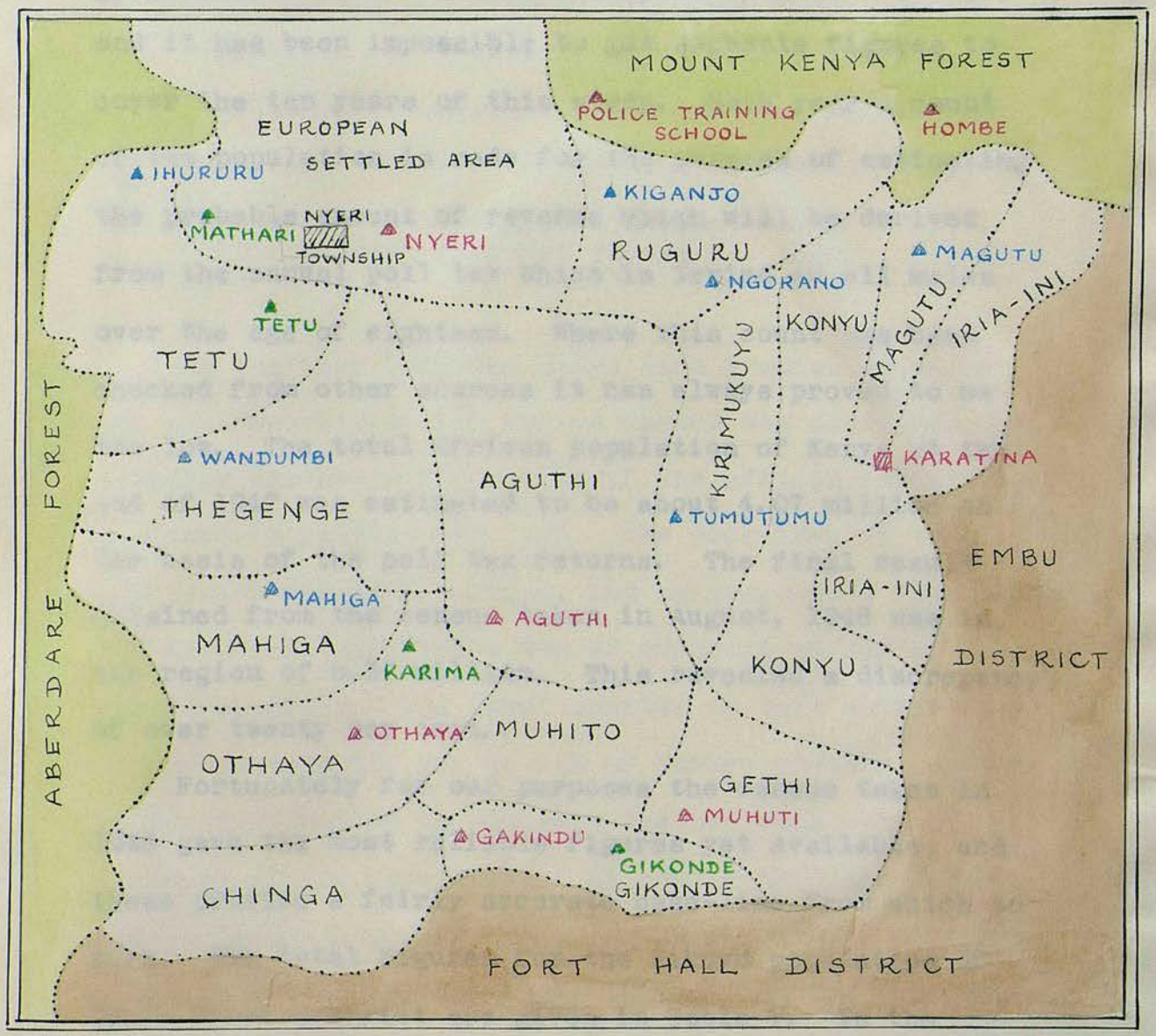
AGENCY	HOSPITAL	DISPENSARIES
Government Medical Dept.	NYERI	7
Church of Scotland Mission	TUMUTUMU	6
Consolata Catholic Mission	MATHARI	3

Table III. Summary of curative medical services in South Nyeri District.

There are certain facts about South Nyeri District which operate to the advantage of a medical survey such as is undertaken in this study. First, medical work was begun early amongst the people. The district was occupied by the administration in 1904, and the first European doctor began work in 1910. Thus the people have had experience of European medicine for almost two generations now. This will mean that they should have great confidence in it, and come more readily for treatment of diseases which otherwise they would hide in their homesteads. Then, this is the only district in Kenya in which three hospitals and three dispensary systems are working in and distributed throughout a compact and well-populated district. Finally, more statistical information is available for the district than for any other district in Kenya. It is one of the two areas where some attempt has been made to collect vital statistics; the other being the Digo district at the Coast. Also, its population statistics were the subject of a special study by Humphreys in 1945.

DIVISION and LOCATION	MEDICAL CENTRE	AGENCY
NORTH TETU		
Tetu	Ihururu Dispensary	CSM
	Tetu Dispensary	CCM
Aguthi	Aguthi Dispensary	GMD
Thegenge	Wandumbi Dispensary	CSM
OTHAYA		
Othaya	Othaya Dispensary	GMD
	Karima Dispensary	CCM
Mahiga	Mahiga Dispensary	CSM
Chinga	--	
SOUTH TETU		
Muhito	--	
Gethi	Mihuti Dispensary	GMD
Gikonde	Gakindu Dispensary	GMD
	Gikonde Dispensary	CCM
MATHIRA		
Kirimukuyu	Tumutumu Hospital	CSM
Konyu	Karatina Dispensary	GMD
Ruguru	Ngorano Dispensary	CSM
	Kiganjo Dispensary	CSM
Magutu	Magutu Dispensary	CSM
Iria-ini	--	
EXTRA-DIVISIONAL		
Nyeri Township	Nyeri Hospital	GMD
Consolata Cath. Mission	Mathari Hospital	CCM
Forest Reserve	Hombe Dispensary	GMD
	Police Training School Dispensary	GMD

Table IV. Distribution of medical centres in South Nyeri District.



MEDICAL CENTRES.

- GOVERMENT MEDICAL DEPT.
- CHURCH OF SCOTLAND MISSION
- CONSOLATA CATHOLIC MISSION

FIG. 3 SOUTH NYERI DISTRICT

THE POPULATION OF SOUTH NYERI DISTRICT

Reliable population figures for the indigenous peoples of Africa are notoriously difficult to obtain, and it has been impossible to get accurate figures to cover the ten years of this study. Each year a count of the population is made for the purpose of estimating the probable amount of revenue which will be derived from the annual poll tax which is levied on all males over the age of eighteen. Where this count has been checked from other sources it has always proved to be too low. The total African population of Kenya at the end of 1947 was estimated to be about 4.07 million on the basis of the poll tax returns. The final result obtained from the census taken in August, 1948 was in the region of 5.37 million. This revealed a discrepancy of over twenty per cent..

Fortunately for our purposes the census taken in 1948 gave the most reliable figures yet available, and these provide a fairly accurate base-line from which to work. The total figures for the Kikuyu population of South Nyeri District are given in Table V. In the census an adult is a person who is over the apparent age of fourteen years.

Our next problem is the determination of the annual increase of the population so that we may then calculate the probable population figure for the other years of our ten year period. Here too we are fortunate in being able to make use of previous investigations.

SEX	ADULTS	CHILDREN	TOTAL
Male	38,170	45,668	83,838
Female	58,357	40,862	99,219
TOTAL	96,527	86,530	183,057

Table V. The Kikuyu population of South Nyeri District in August, 1948.

In the year 1932 the Kenya Land Commission under the chairmanship of Sir Morris Carter was appointed to consider the needs and claims of the African population of Kenya in relation to land. The secretary of the Commission was Mr S.H.Fazan, and he prepared a memorandum for the Commission which was an economic survey of the Kikuyu reserves. The first chapter of this survey was concerned with the population of Kikuyu country, and in it Fazan attempted to estimate the probable rate of increase of the population. He admits that the data available are not sufficient for an absolutely reliable calculation, but he concludes that during the previous decade 1921 to 1931 the average annual increase of the Kikuyu tribe was in the region of one and a half per cent.. The South Nyeri District figures were the most unreliable of all his data, but in his evidence before the Commission the South Nyeri District Commissioner said that he believed Fazan's estimates to be true for that district too.

In a later section of the memorandum Fazan considers the problem of the future increase of the Kikuyu tribe in the light of the conclusions reached in the first chapter. He summarises his conclusions in this later section as follows: "The rate of increase will rise from the present figure of approximately 1.6 per cent. per annum to approximately 2 per cent. by 1941 and will continue at about that rate for the following decade but will ultimately decline, when the effect of a tendency to later marriages has made itself felt."(Kenya Land Commission Report,1933).

Twelve years later,Humphreys published a study of population trends in the South Nyeri District in a booklet which was primarily concerned with the Kikuyu lands. He obtained figures from the district files for the years 1936 to 1945, which were mainly derived from the poll-tax returns. He found that a determined effort had been made to obtain greater accuracy in these returns since 1936 and this explains why he began with this year. After a consideration of the population trends he concluded that "the evidence appears to favour an annual increase of not less than 2 per cent" in the Kikuyu population of the South Nyeri District(Humphreys,1945). Thus both Humphreys and Fazan agree on an estimated annual increase of two per cent. in the Kikuyu population of the South Nyeri District.

The figure of two per cent. did not, however, go unchallenged. In his comments on Fazan's figures the statistician to the Governors' Conference in East Africa

wrote that such a figure "must presuppose a high birth rate. It is unlikely that the death-rate can be much under 25 or 30 per thousand judging by controlled figures from analysis of the native population. With this death-rate, the birth-rate would have to be in the neighbourhood of 55 per thousand and I can but think that this is a very high figure. I should have to have definite statistical evidence before I could accept it."(Kenya Land Commission Report,1933).

The substantial accuracy of the figure of two per cent. has, however, been supported by more recent opinion. Sir Philip Mitchell, former Governor of Kenya, wrote in his famous agrarian despatch of 16th November, 1951 that the "best available evidence seems to point to an annual increase which may amount to 2 per cent. in the most favourable areas." It was this despatch which was partly responsible for the appointment of East Africa Royal Commission on Land and Population in 1953. Also in 1953 Dr C.J.Martin, who is the Director of the East African Statistical Department calculated the average annual increase of the total African population of Kenya to be 1.9 per cent. over the seventeen years 1931 to 1948. In spite of this result, however, he felt that the figure of 1.5 per cent. per annum was more likely to be the true one. In 1955 the Report of the East African Royal Commission already referred to was published, and appended to it was a valuable study of the population trends in East Africa by Mr J.E. Goldthorpe who is lecturer in Social Studies at Makerere

University College in Uganda. Goldthorpe concluded that there "seems good reason to confirm Sir Philip Mitchell's statement that the annual increase 'may amount to 2 per cent. in the most favourable areas.' "(Goldthorpe,1955).

In view of these opinions, the figure of an annual population increase of two per cent. has been accepted for the present study. With this essential figure we now have the necessary data with which to calculate the annual population of South Nyeri District for the ten years 1944 to 1953. The population estimates for this period are given in Table VI on the following page.

Martin(1953) in the study already referred to and which was based on the results obtained in the 1948 census, made an attempt to discover the age structure of the African population of Kenya. His estimate is summarised in Table VII. Goldthorpe(1955) compared the figures given in the two extreme age categories by Martin, with those obtained for other countries. This comparison is given in Table VIII. Goldthorpe comments on this table, which is taken from his memorandum, as follows, that "an age-distribution of this type indicates that, at any rate in the recent history of the population, it has been maintained by a relatively large number of births, whose number is speedily reduced by death; so that if the population is imagined as a pyramid with births as the foundation, the number in each generation dwindles rapidly and the shape of the pyramid is low and flat. By contrast, the age-pyramids of civilised countries are tall and bee-hive shaped. The

YEAR	POPULATION
1944	168,115
1945	172,497
1946	175,947
1947	179,467
1948	183,057
1949	186,718
1950	190,452
1951	194,261
1952	198,146
1953	202,109

Table VI. Estimated annual population of South Nyeri District, 1944 - 1953.

AGE GROUP	UNDER 1	1-5	6-15	16-45	OVER 45
PERCENTAGE	4.5	19.0	24.6	43.2	8.7

Table VII. Percentage age-distribution of African population of Kenya.

impression to be gained from these figures is of a population holding its own against heavy mortality only by the rapid production of babies; and it may be expected that both the birth-rate and the death-rate are high." This state of affairs is described by Crew(1948) as phase II of a demographic cycle through which all the populations of the world are going. In this

phase he includes the larger portion of the population of the world - most of Asia and Africa, most of South and Central America, and all Oceania except Australia, Tasmania and New Zealand. Thus South Nyeri District appears to show the same general picture as most of the rest of Africa - an increasing population which is the resultant of a high birth-rate and a not so high death-rate. What those rates are is the problem we face in our next section.

COUNTRY	Percentage of the population aged	
	under 1	over 45
Eng. & Wales(1951)	1.5	33.3
Japan(1945)	2.4	20.6
India(1931)	3.1	13.7
Kenya(1948)	4.5	8.7

Table VIII. Comparison of percentage of population in upper and lower age-groups in certain countries.

THE VITAL STATISTICS OF SOUTH NYERI DISTRICT.

At the beginning of the year 1944, the Health Department of South Nyeri District began the collection of vital statistics. The collection was on a purely voluntary basis and depended on the co-operation of the local chiefs and their administrative staff. In 1948 the Health Officer responsible for this pioneer venture proceeded on overseas leave and the African District Council took over responsibility for the scheme. The Council appointed a statistics clerk to deal with the work involved. In 1952 they were obliged to withdraw his services on the grounds of economy, and in the District Commissioner's Annual Report for 1952 there appears the following epitaph: "Since reliable data was(sic) not forthcoming the Registration of Births and Deaths in the Native Lands terminated on 31.1.52." There are signs, however, that interest is being revived in this matter and from 1955 another statistics clerk will be responsible for the collection of the figures. The work should be easier and the data much more reliable during the period when the Kikuyu people are "villagised", which is the term used to denote their compulsory concentration in large collections of huts so that they may be protected from Mau Mau terrorism, and also prevented from helping the terrorists with food. It is to be hoped that this second attempt will not be abandoned prematurely, and that figures will become more and more reliable as the people come to understand their value.

In Table IX are given the vital statistics which were obtained by the Health Department for South Nyeri District for the years 1944 to 1950 inclusive. They have been abstracted from the monthly and annual reports of the Health Officer. They are presented to show the results obtained by the Department, and not because they are accurate. The marked variation from year to year is a sufficient indication that they are not an accurate record of what was happening in the population.

YEAR	BIRTH RATE per thousand	DEATH RATE per thousand	INF. MORT. RATE per thousand live births.
1944	27.0	12.0	114.0
1945	38.0	9.0	85.0
1946	23.0	7.4	96.0
1947	16.0	3.0	75.0
1948	20.3	5.5	52.2
1949	15.0	7.1	290.9
1950	10.5	4.6	82.7

Table IX. The vital statistics of South Nyeri District.

Since we are not able to obtain reliable local figures, we must turn the figures which have been worked out for the whole population of Kenya in order to obtain some estimate of the vital statistics of the Kikuyu tribe. This is unsatisfactory, but it is the best we can

do in the circumstances until more reliable local data become available.

We have seen above that Martin(1953) estimated that 4.5 per cent. of the African population of Kenya were under the age of one year. If we accept this figure then it follows that the birth-rate must be at least equal to it, that is, at least forty-five per thousand. Since, however, we must allow for infant deaths during the first year of life, the rate must be higher than this. Goldthorpe(1955) estimates it to be between forty-nine and fifty per thousand, but he goes on to say that a birth-rate as high as this is almost unprecedented. Because of this, Martin(1953) suggests that a more accurate figure for the proportion of the population under one year would be four per cent., and this would make the birth-rate in the region of forty-five per thousand. If this estimate is valid for the Kikuyu people, then it can be seen from Table IX how far short the estimates based on the registrations came. It is worth noting that the highest figures were obtained in the first two years of the attempt, and after that it may be assumed that the interest and enthusiasm of the chiefs began to wane.

The average infant mortality rate for the whole of Kenya is estimated by Martin(1953) to be in the region of 184 per thousand live births. For the Central Province, in which South Nyeri District is situated, he reckons it to be 130 per thousand live births. This figure suggests that this district is one of the "most

favourable areas" to which Sir Philip Mitchell referred in his despatch quoted above. Again it should be noted how far short of this estimate the local figures given in Table IX come in most cases.

The death-rate is more difficult to assess, but it may be assumed that the figures given in Table IX are much too low. Goldthorpe(1955) hazarded the guess that the death-rate for Kenya Africans might be in the region of twenty-eight per thousand, with the adult rate about twenty per thousand, and the infant rate about eight. Martin(1953) concludes as follows: "While mortality rates cannot be calculated from the present information, should the results(i.e. for the other rates) be accurate, as they appear to be, a low general death-rate is impossible." We shall see in a later section that the death-rate for those who died in hospital is only in the region of two per thousand, and so it is not possible to use hospital records as a basis on which to calculate an accurate death-rate.

BIRTH RATE per thousand	DEATH rate per thousand	INF. MORT. RATE per thousand live births.
45	28	130

Table X. Estimated population rates for Africans in Kenya.

THE CLIMATE OF SOUTH NYERI DISTRICT

The former Director of the East African Meteorological Service has written several articles on the climate and weather of East Africa. He points out(Walter, 1934) that the chief controlling factors in the climate of any region are three: latitude, altitude, and the relation of the region to the land and water masses of the globe. So far as latitude is concerned, South Nyeri District is for all practical purposes situated on the Equator for it does not extend to the one degree line of south latitude, southwards from the Equator. Because of this position the District knows none of the seasonal variations which are characteristic of temperate climates. Its only variation is in the presence or absence of rain, in the alternation of periods of drought and heavy rainfall.

The altitude of the District is about six thousand feet above sea level on the average, and this altitude modifies considerably what would otherwise be an unpleasant tropical climate. According to Walter(1934) the temperature falls one degree Fahrenheit for every three hundred feet above sea level, and therefore at six thousand feet it tends to be cool and pleasant for most of the year.

The District lies at the foot of one of the largest mountain masses of East Africa and this results in an increase in its rainfall in comparison with other districts not so situated.

East Africa has been called "the land of double summer"(Huxley,1935)* because of its two dry seasons each year. The year is divided up into four seasons as follows:

Jan. to Mar.: The short dry season,
Mar. to June: The long rainy season,
June to Oct.: The long dry season,
Nov. to Dec.: The short rainy season.

These four seasons may be characterised in the following terms after the description given by van Someren(1952) for the South Nyeri District.

The short dry season is the season of the year's greatest heat, which becomes maximal just before the rains break in March. The morning sky is dominated by cirrus or cirro-stratus clouds, which change in the afternoon to fair-weather flat-bottomed cumulus. Visibility is high. The temperature ranges from 50° to 82° Fahrenheit. The winds are light and north-easterly. The nights are clear with a heavy dew and intense radiation. The humidity falls from about ninety per cent. at seven o'clock in the morning to about fifteen per cent. at four o'clock in the afternoon. Later in this season occasional thunderstorms develop in the afternoons. These are called the "grass rains" because they keep the grass green in those areas which are fortunate enough to have them. As the rains approach, the wind veers round to the south-east and the weather becomes sultry and very oppressive.

Towards the end of March, traditionally on the

* HUXLEY, E. (1935). White Man's Country 1st edn. vol.1 p.217. London: Macmillan.

twenty-third, the rains begin, brought by the south-east monsoon. At this season, which is the season of the long rains, the mornings are clear with some lenticular alto-cumulus or high strato-cumulus in the sky. In the afternoon they change to cumulo-nimbus and fracto-nimbus and the rain falls about three-thirty and often continues into the night. It rains almost every day, though there are occasional sunny days. The wind is south-easterly and attains force three or four on the Beaufort scale, that is, a gentle to moderate breeze. The air temperature shows a slightly smaller range of variation than in the previous dry season from 50° to 76° Fahrenheit. The humidity is high and is seldom below fifty per cent. at four o'clock in the afternoon.

After the long rains comes the long dry season. The first part of this season is characterised by mists. The sunshine is minimal and the weather is cold and dull. The mornings are misty, but the mist commonly rises by noon to reveal a sky covered with stratus or strato-cumulus clouds. There is a light morning dew and the relative humidity does not fall below fifty per cent.. The temperature range is similar to that of the previous rainy season, whilst the winds are light, but still south-easterly. The second part of the long dry season lasts from September to October. It has clear sunny weather with fair-weather cumulus cloud formations. There is little wind and visibility is high. The days are warmer and the nights are colder.

The short rainy season begins in early November and

lasts until late December. The weather is similar to that of the long rainy season. The rain this season is brought by the north-east monsoon. It falls chiefly in the afternoon and evening. The afternoon sky is filled with cumulo-nimbus and fracto-nimbus cloud formations. Thunderstorms are not infrequent in the afternoons. The temperature range is from 50° to 77° Fahrenheit.

The Kikuyu calendar is essentially that of an agricultural people. It includes some of the few natural history observations the tribe has made in its time. It is of interest to set it out in the form it is given by Beecher and Beecher(1938).

1. MUGAA or the hot season: January to March.

   KAGAA or the early warm days.

   MUGAA or the later hot time.

2. MBURA YA NJAHI or the rains when beans are planted: March to June.

   MURINGO or when the rains break.

   KIHU or the time of the earth's conceiving when the first green shoots appear in gardens.

   MUGIRA-NJARA or the time when the hand is stayed, i.e. when there are no tribal initiations, in the months of April and May.

   GITHANANWA or the time when the Pleiades shine.

3. MUTHATU of the misty season: June to August.

   GATHATU when the mists begin.

   MUTHATU or the misty days of June.

   MWORIA-NYONI or when the birds die of cold(July).

   GATHANO or the cold misty days of August.

   MUTHANO-MUUMU or the time of the dry mists.

4. MUGAA or the second hot season: September to October.

5. MBURA YA MWERE or the rains when millet is planted: November to December.

MURINGO or when the rains break.

KIHU or the time of the appearance of the shoots.

GITHANANWA or the time when the Pleiades shine: November.

6. GATUMU or the time when the millet is bursting through its sheath, the time of the approach of harvest in December and early January.

So far we have been concerned with the description of the climate and weather of South Nyeri District, rather than with its measurement. Such measurement is necessary if we are to achieve any correlation of climate with the incidence of disease. The measurement of climatic and weather changes involves the determination of the following six values(Walter,1934):

1. Air temperature,
2. Barometric pressure,
3. Relative humidity,
4. Rainfall,
5. Wind direction and velocity, and
6. Intensity of the sun's rays.

Data are available for four of these six features. The barometric pressure over the greater part of East Africa is between twenty-five and twenty-six inches. No detailed records of the direction and velocity of the wind appear to have been kept in South Nyeri District. The data for the other four features were kindly supplied for South Nyeri District by the East African Meteorological

Service. The annual figures are given in Table XI and graphically in Figure 4, whilst the monthly figures are in Table XII and Figure 5.

YEAR	MEAN TEMPERATURE	MEAN RELATIVE HUMIDITY	AVERAGE RAINFALL	MEAN CLOUD AMOUNT
1944	63.0°F.	71.0%	41.13"	5.6
1945	63.2°F.	65.5%	43.46"	5.8
1946	62.8°F.	67.0%	42.75"	5.8
1947	62.5°F.	71.0%	59.62"	5.7
1948	62.8°F.	68.0%	37.98"	5.3
1949	62.7°F.	65.0%	24.14"	5.0
1950	62.5°F.	70.0%	51.92"	6.4
1951	62.5°F.	75.5%	65.55"	6.9
1952	62.5°F.	70.5%	32.13"	5.4
1953	61.9°F.	69.5%	44.22"	6.0
AVER.	62.6°F	69.3%	44.29"	5.8

Table XI. Annual climatic data for South Nyeri District for the years 1944-1953.

The figure for the mean cloud amount is obtained from observations in which the sky is roughly divided up into eighths and then a note is made of the number of eighths which are composed of clouds. The figures given in the last column of Table XI and of Table XII are therefore in eighths of the sky. They give a rough idea of the amount of sunshine experienced during any

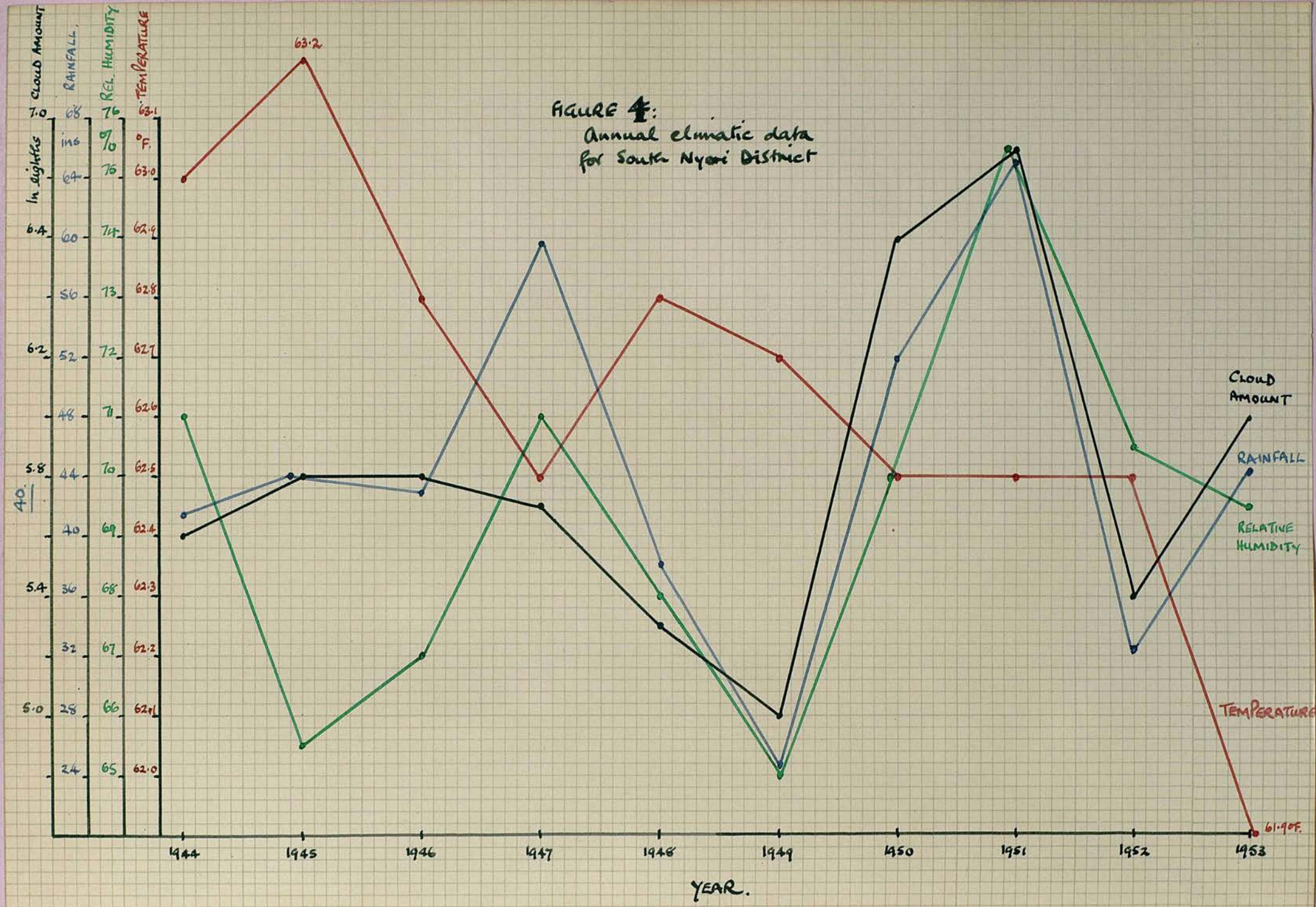


FIGURE 4:
Annual climatic data for South Nyori District
CLOUD AMOUNT
RAINFALL
REL. HUMIDITY
TEMPERATURE
In eighths
ins
%
°F.
7.0
6.4
6.2
5.8
5.4
5.0
68
64
60
56
52
48
44
40
36
32
28
24
76
76
74
73
72
71
70
69
68
67
66
65
63.1
63.0
62.9
62.8
62.7
62.6
62.5
62.4
62.3
62.2
62.1
62.0
63.2
61.9°F.
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
YEAR.
CLOUD AMOUNT
RAINFALL
RELATIVE HUMIDITY
TEMPERATURE

one period.

MONTH	MEAN TEMPERATURE	MEAN RELATIVE HUMIDITY	AVERAGE RAINFALL	MEAN CLOUD AMOUNT
JAN	65.5°F.	59.0%	1.04"	4.1
FEB	66.1°F.	55.5%	0.64"	4.2
MAR	65.5°F.	60.5%	2.80"	4.9
APR	63.8°F.	69.5%	10.29"	5.7
MAY	62.9°F.	71.5%	9.79"	6.3
JUN	61.4°F.	68.5%	1.33"	6.2
JUL	58.7°F.	81.0%	1.30"	7.2
AUG	60.3°F.	76.5%	2.03"	6.6
SEP	62.6°F.	70.5%	2.13"	6.5
OCT	63.9°F.	67.5%	4.93"	6.2
NOV	62.6°F.	69.5%	5.22"	6.2
DEC	63.3°F.	63.0%	2.54"	5.4
AVER.	63.0°F.	67.7%	3.68"	5.8

Table XII. Monthly climatic data for South Nyeri District over the years 1944-1953.

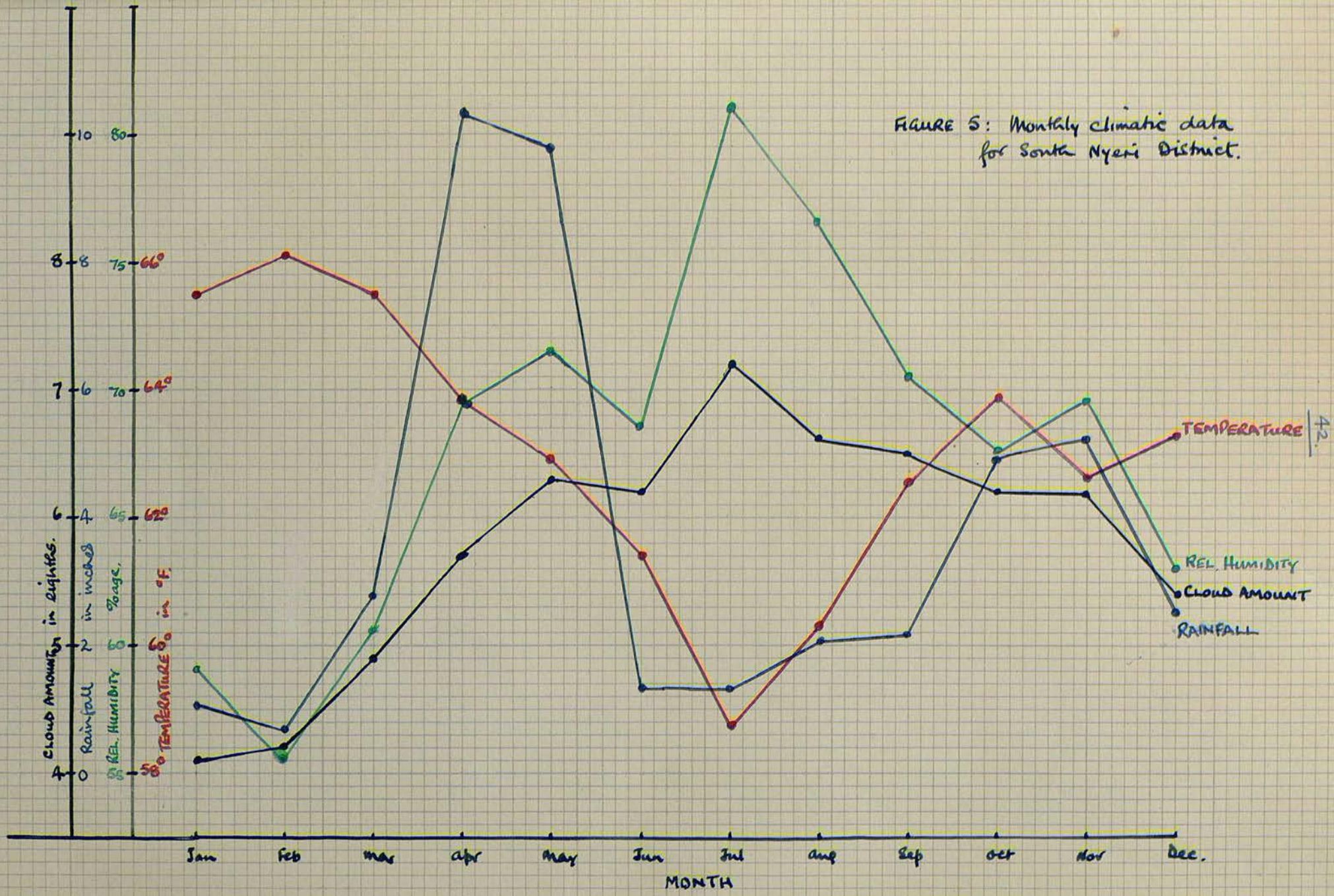


FIGURE 5: Monthly climatic data for South Nyeri District.

SECTION III. FACTORS INFLUENCING THE DATA OF THIS STUDY.

1. Those influencing the morbidity and mortality.

2. Those influencing the reliability of the statistics.

THE FACTORS WHICH INFLUENCE MORBIDITY AND MORTALITY

In this section an attempt will be made to summarise those factors which influence the morbidity and mortality of any community. These factors will be discussed with special reference to the conditions which prevail amongst the Kikuyu people. There is one source of difficulty which must be borne in mind throughout our discussion, and that comes from the fact that the Kikuyu, in common with all the peoples of Africa, are in a state of transition. They have begun to move away from their old tribal life towards the ways and customs of Western civilisation. Our discussion will be concerned primarily with traditional Kikuyu life and custom, but where this has changed, such a change will be noted if it is of importance for our purposes. We shall discuss the factors according to the following scheme:

HEREDITY:

1. Physical:
    a. Racial factors
    b. Tribal factors
    c. Sex and age
    d. Somatic factors
2. Mental factors.

ENVIRONMENT:

1. Altitude
2. Climate
3. Housing

4. Sanitation

5. Exposure to infection

6. General factors

NUTRITION:

1. Soil

2. Crops

3. Diet

TRAINING:

1. Beliefs

2. Habits

HEREDITY:

Heredity includes all that we receive from our parents and which they in turn have inherited from the generations which have gone before. It includes our bodies and our minds, and there can be no doubt that our inheritance of body and mind have a profound influence on our medical history, and this is as true of the African people as for other peoples of the world.

The Kikuyu are of Bantu origin, and there are certain diseases to which the Bantu and other African peoples are more prone to contract than other races are. A list of these diseases is given in Table XIII. It is, of course possible to maintain that these diseases are not related to race, but to environment or to nutrition, and the inclusion of Table XIII here is not meant to prejudge the issue. At present, however, it appears to be difficult to explain such syndromes as Kaposi's disease,

GROUP	DISEASE
Infectious diseases	Tuberculosis of the lungs Tuberculoma of the brain Pneumococcal infections
Neoplasms	Primary liver carcinoma Epithelioma of skin Melanoma of skin Kaposi's disease(sarcoma)
Malnutritional states	Kwashiorkor Subnutrition
Circulatory diseases	Lymphoedema
Digestive diseases	Intestinal volvulus Inguinal hernia Diseases of the liver
Blood diseases	Sickle-cell disease Onyalai
Skin diseases	Tropical ulcer Dermatosis papulosa nigra
Fibroplastic diseases	Keloid formation Ainhum Endomyocardial fibrosis

Table XIII. Diseases peculiar to or unduly common amongst Africans.

onyalai or the fibroplastic disorders on a purely environmental basis. An even more interesting list is of those diseases which are unknown or very rare amongst Africans. This is given in Table XIV which represents an expansion of the list given by Davidson after his brief African tour(Davidson,1954).

GROUP	DISEASE
Infectious diseases	Streptococcal infections
	Diphtheria
	Rickettsioses
Neoplasms	Digestive tract neoplasms
	Reticuloses, e.g. Hodgkin's disease
Allergic disease	Hayfever
	Eczema
	Atopic dermatitis
Endocrine diseases	Pituitary syndromes
	Toxic goitre and myxoedema.
	Diabetes mellitus
	Addison's disease.
Blood diseases	Iron deficiency anaemia due to deficient intake
	Megaloblastic anaemia
	Aplastic anaemia
	Agranulocytosis
	Haemophilia
Mental diseases	Anxiety states
Nervous diseases	Motor neurone disease
	Demyelinating diseases
	Syringomyelia
	Subac. combined degeneration
	The Muscular diseases, e.g. the dystrophies, myasthenia
	Migraine
Eye diseases	Glaucoma
Circulatory diseases	Coronary disease
	Essential hypertension
	Cerebral vascular disease
	Peripheral vascular disease
Digestive diseases	Peptic ulcer
	Cholecystitis & gallstones
	Appendicitis
	The steatorrhoeas
Pregnancy disorders	Eclampsia & the toxaemias
Skin diseases	Furunculosis
	Acne vulgaris
	Seborrhoeic dermatitis

cont.

GROUP	DISEASE
Skin diseases(cont.)	Psoriasis
	Rosacea
	Lupus vulgaris
	Lupus erythematosus
	Alopecia senilis
Rheumatic diseases	Rheumatic fever
	Rheumatoid arthritis
	Osteoarthritis
	Gout
Heat syndromes	Heat-stroke, etc..

Table XIV. Diseases unknown or rare in African peoples.

In the present state of our knowledge it is not possible to say whether the absence of a disease from African medical practice is due to genetic or environmental factors. It is probably significant, however, that a number of the diseases included in Table XIV show a lower incidence in Europeans who live in and around Nakuru in the Kenya Highlands than in those who live in Britain(Charters,1951). Amongst the illnesses which showed a greater prevalence in Britain than in Kenya Europeans, Charters included diphtheria, scarlet fever, rheumatic fever, rheumatoid arthritis, pernicious anaemia and disseminated sclerosis. It may be suspected that there is an environmental factor at work in determining the incidence of these diseases.

All the so-called diseases of civilisation are included in Table XIV as absent or rare amongst the African people.

Evidence is accumulating, however, that such diseases as hypertension and peptic ulcer are not uncommon amongst the more highly educated Africans who adopt a European way of living. It is thus probable that the absence of these diseases is due not to any genetic factor, but to an absence of the stresses associated with civilisation in the normal African environment.

Davies(1949b) has suggested a possible pathological mechanism which operates in Africans as a result of protein malnutrition. Such malnutrition damages the liver by producing fatty change and fibrosis. As a result the functions of the liver are impaired, and in particular that of detoxification of hormones. Davies suggests that the significant hormones in the case of the African are the oestrogens, and he points to the feminisation of the African male and the occurrence of gynecomastia as evidence of this process of oestrinisation. This process has pathological implications. Oestrogens are known to inhibit the thyroid gland activity, and this may be the reason for the rarity of thyrotoxicosis in Africans. Then, oestrogens are found to cause inguinal hernia in mice and this hernia is common in the African. Primary liver carcinoma is common in the African, and this may be partly associated with the fact that the oestrogens can act as carcinogens and have produced liver tumours in animals. This correlation is an attractive one but we need much more information before it can be firmly established.

Here we must leave the problem of the genetic factor

in the incidence of disease in Africa. It is probable that heredity will prove to be much less important than the environment in determining the incidence of disease in Africa.

The physical characters of the tribe are probably not of great importance in influencing disease incidence. They are of medium height. Routledge(1910) gives 5 ft. 4 in. as the common height of the men, whilst the women are considerably less. With the notable exception of the girls of marriageable age, the people are thin and slender. They were never noted for their strength or prowess in war. They overcame their hereditary enemies, the Masai, by cunning rather than by force. Because of their small capacity for heavy work, the Kikuyu were not popular as slaves. There is a note in the old records of the Zanzibar slave market which reads as follows: "Kikuyu, practically useless", i.e. as slaves(Carey,1953).

Sex and age are important factors in determining the incidence of disease and death. We shall come across frequent illustrations of this in the pages that follow. Also, the decreased expectation of life which prevails amongst African peoples means that there is a low incidence of diseases of the later age groups.

The most obvious somatic character inherited from previous generations is the pigmentation of the skin which is more marked in the African than in any other race. At birth, the amount of pigment present in the skin varies. Some infants are almost as pink as European babies, whilst others are definitely brown. The iris is brown from birth and the so-called Mongolian spot is very commonly observed

over the sacral region. The pigment absorbs the heat rays of the sun and protects the skin from sunburn. The price paid by the African for this protection is the increased incidence of melanoma, both benign and malignant. There are albinos amongst the Africans, and it is probable that the reports of the early travellers that they had seen fair-skinned tribes in the interior of Africa referred to the presence of albinos there. Lewis(1942) states that albinos "are found quite frequently among the natives" of Africa. In South Nyeri District, I can recall seeing only three albinos in five years. They tend to suffer from a severe chronic solar dermatitis and an increased liability to skin carcinoma. Charters(1951) suggests that the flat African nostril may be an adaptation to minimise the effects of a dry environment, and may explain why the European with his more open nostril commonly suffers from nasal sinusitis, whereas the African does not.

The incidence of congenital abnormalities amongst the Kikuyu, as amongst the Africans generally, is not known, but almost all the defects which occur in the European have been seen in the African(Kenya Medical Department, 1950). Polydactylism and the presence of accessory nipples is more common amongst the Kikuyu than amongst the white people, but a true estimate of their incidence is difficult to obtain since they are not conditions for which people seek medical aid.

Any adequate assessment of the mental factors in

the incidence of disease is hampered by lack of knowledge. African psychiatry is a new field and much work has yet to be done in it. Even so, Carothers(1954) is able to say that "it has become increasingly clear in recent years that no fundamental differences between different groups of Africans, or even between Africans and Europeans, have yet been demonstrated. It is possible that intrinsic differences do exist but, if so, they are probably quite slight and at present undiscoverable." He is speaking of the general mental characteristics of untouched rural Africans with special reference to the Kikuyu people. Westermann(1939) characterises the thought of the African as "emotional, momentary, and explosive" dependent on external influences and stimuli. He goes on to say that "the interest which the African takes in things is not an academic one. They concern him in so far as they are useful to him or can do him harm ... observation is often superficial; conclusions have been drawn from it in a most uncritical way; and instead of further thought on on the matter, word spinning has seemed sufficient ... knowledge mixed with a child-like play of the imagination." This is reflected in his thinking about disease, and we shall have occasion later to refer to some of the superficial judgements which the Kikuyu have passed on diseases which afflict them.

In common with most African peoples, the Kikuyu appear to be less sensitive to pain than more civilised races are. Whether this is true or not is difficult to assess, but it is a definite clinical impression. The result is that they will

endure painful diseases much longer than a European patient would, and too often they come for medical aid when the condition is too far advanced for treatment.

ENVIRONMENT:

Environmental factors are of great importance in determining the incidence of disease amongst the African peoples. The factors we shall discuss in this section are altitude, climate, housing, sanitation, exposure to infection and certain other general factors.

Altitude: The influence of altitude upon health and disease is a subject which has received surprisingly little attention. In East Africa and elsewhere, much is blamed on the altitude but little is known about its true influence. There is no doubt that altitude does alter the pattern of disease, but the details of this alteration have yet to be fully investigated. The monograph of Loewy and Wittkower(1937) is a convenient summary of our knowledge and has not yet been superseded.

The details of physiological acclimatisation to high altitude are well-recognised. They include the changes in the blood which increase its capacity to carry oxygen, and those in the respiratory system which tend to increase the oxygen supply to the alveoli. According to Loewy and Wittkower(1937) these adaptations are well established even at six thousand feet above sea level, which is the average altitude of South Nyeri District. Unfortunately no studies of these adaptations have been made amongst the Kikuyu.

When we come to the influence of altitude upon disease, the picture is much less detailed. Certainly the specific altitude diseases do not occur in the Kikuyu in their normal life, though Kikuyu guides and porters have experienced mountain sickness in climbing Mount Kenya. Loewy and Wittkower(1937) have shown that certain diseases which, though not specific for high altitudes, do show certain peculiarities when they occur there. Thus pneumonia is a much more fatal disease at high altitudes than at low ones. This is true also of acute intestinal infections, especially in infants. Heart disease shows a lower incidence and mortality at High altitudes. In general, the death rate, especially amongst infants, is higher at high altitudes than at low. In our study of disease and death amongst the Kikuyu, we shall certainly find that all these facts apply to them too, but we must remember that altitude is only one factor influencing the occurrence of disease and death amongst them. We shall find other factors at work which are likely to be more important than altitude. I feel that, in their enthusiasm, Loewy and Wittkower have not always given these other factors their due weight in assessing the influence of high altitude on disease incidence.

Climate: The climate of South Nyeri District was discussed in a previous section. Here we are concerned with the specific climatic factors which influence the incidence of disease.

According to Walters(1934) the air temperature is the chief determining factor in weather production.

Variations in air movement, humidity, cloud formation and even rainfall can all be correlated with variations in the air temperature. Sir Leonard Rogers was one of the pioneers in the study of the influence of climate upon disease incidence, and he stressed the humidity of the air as the significant factor. In this he has been followed by more recent workers. Rogers was able to test the validity of his ideas on the relation of climate and disease incidence by making them the basis on which he forecast the probable incidence of such diseases as cholera, plague and smallpox in certain areas of India(Rogers,1930 & 1933).

For his studies Rogers took the absolute humidity of the air; other workers have taken the relative humidity. Recently, White(1954) working in East Africa has used the water evaporation rate as an index of the dryness of the air. He exposes a graduated glass cylinder of water to the air and records how many inches the water level falls in twenty-four hours. All these three values are indices of the dryness of the air, and there seems to be no doubt at all that the incidence of disease is related to the humidity of the air.

In a later section we shall endeavour to correlate disease incidence in South Nyeri District with the climatic data given in the previous section on the climate of the District.

Housing: The Kikuyu hut is made of a wattle framework on which is daubed mud and a special kind of clay which is used for the outside layer of the wall. The

roof is thatched with grass. Routledge(1910) describes the Kikuyu hut as "strong, comfortable, and well-built" and reckons that it should last a lifetime if kept in good repair. The Kikuyu themselves reckon that the life of a hut built in the traditional way is about fifteen years. Under the old pagan way of life there was little incentive to build more permanent structures since if a person died in a hut, that hut had to be demolished. To-day, more and more of the Kikuyu are building in stone; and they are building square houses instead of the traditional round hut. A typical Kikuyu hut of the old style is shown in Figure 6.

Traditionally, the husband had his own hut in which he slept at night and entertained his male friends. Each wife under the old polygamous system of the Kikuyu had her own hut in which her children and a proportion of the sheep and goats slept at night. A typical ground plan of a wife's hut is shown in Figure 7.

With the breakdown of the polygamous system, the tendency is for the whole family to occupy one hut, and therefore to share each other's infections. The following are the ways in which the typical Kikuyu hut may influence the incidence of disease:

1. It is completely devoid of light as there are no windows. Some small windows are included in the more modern structures, but they are closed with shutters which do not admit light.

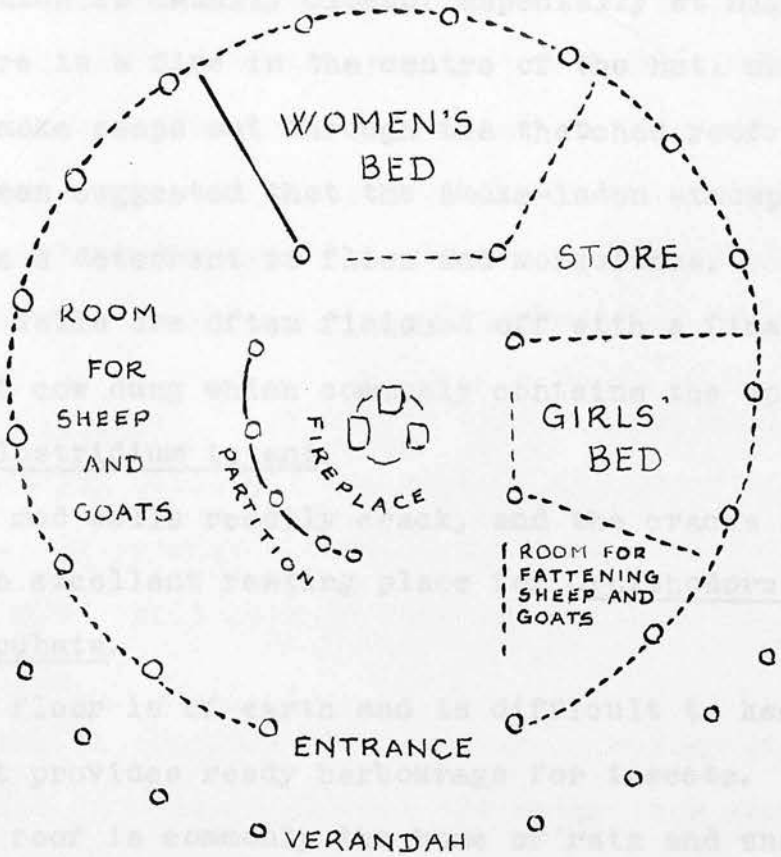
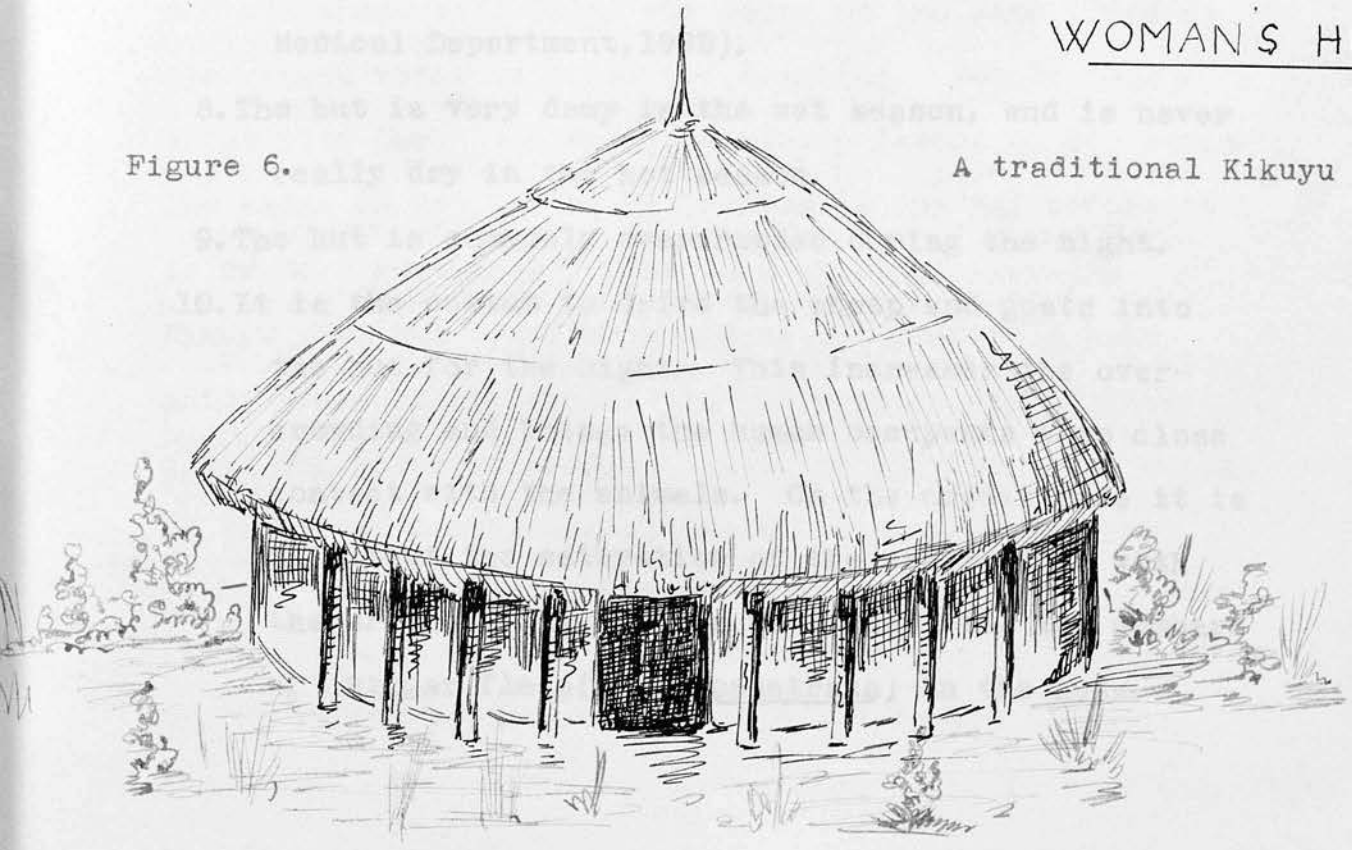


Figure 7.

GROUND PLAN OF WOMAN'S HUT

Figure 6. A traditional Kikuyu hut.



2. There is no ventilation except through the doorway which is usually closed, especially at night.
3. There is a fire in the centre of the hut, and the smoke seeps out through the thatched roof. It has been suggested that the smoke-laden atmosphere acts as a deterrent to flies and mosquitoes.
4. The walls are often finished off with a final layer of cow dung which commonly contains the spores of Clostridium tetani.
5. The mud walls readily crack, and the cracks afford an excellent resting place for Ornithodorus moubata.
6. The floor is of earth and is difficult to keep clean. It provides ready harbourage for insects.
7. The roof is commonly the home of rats and snakes. As many as sixty rats may live in one roof (Kenya Medical Department, 1922).
8. The hut is very damp in the wet season, and is never really dry in the hot season.
9. The hut is commonly overcrowded during the night.
10. It is the custom to drive the sheep and goats into the hut for the night. This increases the overcrowding and brings the human occupants into close contact with the animals. On the credit side it is said that the saturation of the earth floor with the urine of the animals will keep down the numbers of chigger fleas (Tunga penetrans) in the huts.

All these features have immediate relevance to the occurrence of disease amongst the Kikuyu people. In view of this, it is not surprising that an early medical report characterised the Kikuyu hut in the following terms: "The ordinary grass-roofed wattle and daub native hut is perhaps the most insanitary dwelling that can be constructed or imagined."(Kenya Medical Department,1922)

Sanitation: In primitive Kikuyu life, sanitation in the modern sense did not exist. The older non-sanitary habits still persist alongside the newer and more sanitary ones, and we shall have to take note of both in our description.

Water is obtained from a river, a stream or a spring. No attempt is made to protect the water from contamination. The river is used for bathing and for watering the herds and all these activities may occur at the same place as that where water is drawn for drinking. People pass urine into the river and leave their faeces on its banks. The water is not boiled or treated in any way before it is drunk. Fortunately from this point of view the Kikuyu does not drink much water, but prefers a thin maize gruel as his drink. In the preparation of this gruel the water is brought almost to boiling point which is about 95° Centigrade at the altitude of Kikuyuland. To-day, the Health Department is endeavouring to protect all springs from contamination by having them fenced in and by providing a concrete basin and trough to collect the water. The people are being encouraged to boil the

water, and are being inoculated against enteric fever.

Food is stored as maize cobs in large wicker baskets raised on wooden piles and covered with a thatched roof. In former times there was nothing to prevent rats from getting into the stores, but to-day there is a law by which all such maize stores must have metal disc rat excluders fixed on all the wooden piles. This law is not always obeyed. Small quantities of food for daily use are stored in the huts in baskets made from sisal fibre, and these are not protected from rats in any way.

There were no proper arrangements for the disposal of household water and refuse. Sullage water, of which there was not very much, was just thrown out of the calabash on to the ground outside the hut. Household refuse consisted mainly of food waste, of which the Kikuyu had much. Dr Philp used to say that the Scots could live on what the Kikuyu threw away. This waste and the ashes of the hut fires were all thrown on to a heap at the entrance to the homestead, and there made a midden where flies might breed and wild animals forage.

Urine and faeces were passed in the bush or uncleared land outside the homestead. Here the faeces remained uncovered and a source of infection to people and cattle, and this explains the continuance of such infestations as those due to roundworm, tapeworm and hookworm. After defaecation the perineum was wiped with leaves which were then thrown away. The hands were not washed after either micturition or defaecation, and so

any contamination was passed on to the food. To-day most homesteads have their own deep pit latrine built as a result of propaganda and persuasion by the local Health Department staff. It is still difficult to ensure that the family uses it and keeps it clean. The present stage of "villagisation" of the Kikuyu affords a valuable opportunity to supervise their sanitation, and it is probable that the deep pit latrine will come into almost universal use after this.

In the old Kikuyu economy, burial of the dead was uncommon, and was reserved for the rich and the very old. In other cases the common practice was for the body of the dead or dying person to be taken out into the bush and there left for the hyaenas to dispose of. If a person died in a hut, the body might be left there and a hole made in the wall for the hyaenas to enter(Routledge,1910). These practices were based on the Kikuyu belief in thahu or ceremonial uncleanness, which will be referred to in more detail below. To-day, it is probably true to say that most families bury their dead. We have often had moribund patients brought to us in hospital by their relatives, and we have suspected that they were brought not for treatment, but so that we could bury the body after death. The families in these cases were invariably pagan.

Exposure to infection: The routes by which the Kikuyu contract infection are not different from those which are found in other parts of the world. Nevertheless

it is worth making a few remarks under this heading with special reference to the Kikuyu people and their environment.

The older generations of the Kikuyu knew little of the modern concept of disease transmission, but they had been able to make a few relevant observations. They recognised that diarrhoea might follow the ingestion of diseased meat, that epidemics usually spread along the normal lines of communication, and that certain diseases were contagious(Barlow,1924). Their general theory of disease, however, was that it was due to the malign influence of the dead, or the curse of a dying parent, or to the evil eye. On such a theory, the means by which disease is contracted is not important, and therefore is not investigated. With the passing of the older traditional beliefs and the widespread hygiene propaganda disseminated through the schools, the Kikuyu people are now learning the facts of disease transmission, and are beginning to help in the prevention and control of disease.

Infection may reach an African reserve along the normal lines of communication, and the people in that reserve may share in any epidemic which is raging in the country as a whole. This is well illustrated by the history of the origin of the influenza pandemic in Kikuyuland during 1918-1919. A party of African soldiers had been to Nairobi to receive their medals and awards from the Governor. Whilst in Nairobi they were infected with influenza. On their way back they fell ill at Fort

Hall and were kept in hospital there. In spite of attempts to isolate them, they infected others and the first wave of the pandemic swept outwards from Fort Hall into Kikuyuland. Many thousands died in that pandemic which came to the Kikuyu in so simple a way(Philp,1918).

We have already discussed the Kikuyu hut which is an excellent environment for the spread of droplet infections and contagious diseases. The overcrowding of huts in the country areas is not so serious as in the towns whither many Kikuyu youths and men go in search of work. In the towns are the main foci of tuberculosis and many Kikuyu men have contracted pulmonary tuberculosis there and have taken the infection back to the reserves with them. In the towns too, venereal disease is rife and many of the Kikuyu have contracted it there and then taken it back to the country.

Infections have been spread by the contact of different races, and it is probable that several diseases now common amongst the African population were introduced from overseas. Examples of such diseases are syphilis, gonorrhoea, tuberculosis and trachoma.

One of the important sources of infection amongst a rural people such as the Kikuyu is the animals with which they come into contact. This will be referred to again when we discuss the different zoonoses, but this is a convenient place at which to summarise the subject. Human contact with animals is much closer in Africa than it is in Europe. The sheep and the goats are herded into the huts at night, and the cattle are kept in a kraal in

the homestead for the night. The breeding of pigs is becoming more common. Dogs and cats roam through the homesteads, and rats and snakes live in the thatched roofs of the huts. Animals may influence the incidence of disease in two ways: By being the actual source of the infection, or by destroying food and so interfering with the nutrition of the people. In Kikuyuland the latter method does not operate under normal conditions for food is usually plentiful.

Table XV sets out the relationship between animals and disease as it exists in Kikuyuland to-day. The table is not complete from an epidemiological point of view for it includes only the commoner possibilities. For instance, anthrax can be contracted from cattle, sheep and goats, but most cases are contracted from cattle amongst the Kikuyu and this explains why anthrax is given opposite cattle only. Also, leptospirosis icterohaemorrhagiae has a well-recognised association with rats, but since this disease has never been recognised in South Nyeri District, it is not included in the table. Another obvious omission is any reference to wild animals for it is doubtful if any of the diseases seen in South Nyeri are derived from them. The route of transmission of disease may not always be from animal to man, but may sometimes be from man to animal. In Uganda Carmichael(1938) found a sheep suffering from tuberculosis due to the human strain of the bacillus. Unfortunately no details were forthcoming and so we do not know whether the infection had actually been derived from a human case.

ANIMAL	DISEASE
Cattle	Anthrax
	Brucellosis
	Q fever
	Taeniasis saginata
	Tuberculosis
Sheep	Rift Valley fever
	Tuberculosis
Goats	Brucellosis
Pig	Taeniasis solium
Dog	Rabies
Rats	Hymenolepis nana
	Plague
	Rat-bite fever
Snakes	Envenomisation

Table XV. Relationship of animals and human diseases in Kikuyuland.

Several diseases have been included in the above table on whose incidence amongst the Kikuyu information is lacking. There seems to be no valid reason why some of the mysterious fevers which are often labelled as influenza etc., should not be due to as yet undetected causes which are well-recognised elsewhere. Q fever is a case in point, and it has been found that amongst Kikuyu detained in Manyani Detention Camp for Mau Mau offences, about 5 per cent. show Q fever antibodies in their blood(Brown,1955). Further work is in progress on the distribution of Q fever and will shortly be published(Cooke,1955). Then Rift Valley fever was originally described from Kenya, and as the Rift Valley

passes but a few miles from the border of Kikuyuland there seems to be no reason why it should not occur there, but sera have not yet been tested for it on any large scale. The pig is not much used as food by the Kikuyu and therefore few infections with Taenia solium are found. Carter(1953) working in Nairobi described a case of cysticercosis in a Kikuyu girl from the Fort Hall District. There seems to be no reason why an occasional case of trichinosis should not be seen, but none have yet been recognised. Rat-bite fever occurs only rarely in East Africa and only four cases had been described by 1950. Heisch(1950) described a case in a Kikuyu male adult in Nairobi from which he was able to isolate Spirillum minus.

General factors: There are certain general factors in the environment of the people which influence the incidence of disease to a greater or lesser extent. Occupation does not play a great part in the incidence of disease in Kikuyuland, at least not in the specialised sense in which the term is understood in European legislation. There are few occupational diseases. The majority of the people are peasants and work on the land or in petty trading. The most definite occupational disease I have seen is a contact dermatitis due to diesel oil in the men who drive the diesel lorries for the saw-mills on Mount Kenya.

The efficiency and availability of the local health services is a vital factor in the control of disease, and

it can be said at once that the record of the South Nyeri Health Department is excellent in this respect. There are many examples of this, but two good ones are in the control of anthrax and tick-borne relapsing fever. In the case of anthrax the notifications from the district fell from 172 in 1947 to 5 in 1953, and this was mainly due to the patient propaganda of the Health Department. In the same manner, the number of cases of relapsing fever fell from 296 in 1947 to 33 in 1953. In both cases it is probable that several factors were at work, but one of the chief ones was the activity of the local Health Department.

Immunisation is another activity of the Health Departmentmand this has played its part in the control of such diseases as smallpox and enteric fever, and also when the occasion demanded it, of plague.

NUTRITION:

The soil of South Nyeri District is very fertile. Its fertility is, however, rapidly reduced by the common Kikuyu practice of shifting cultivation in which a piece of land is completely exhausted and then abandoned and the process repeated on another piece. The Kikuyu knew nothing of the principle of the rotation of crops, but they did realise that after some seasons of planting maize, the soil became exhausted and needed a rest. They had not discovered the use of manure and were at first very reluctant to use it. It is recorded that one of the first land-owners near Tumutumu to use manure on

his maize crop, awoke one morning to find that the local reactionaries had cut down all his maize during the night as a protest against his new-fangled ways. To-day, however, the value of manure is well-recognised and fairly widely practised. The soil consists of a reddish-brown laterite which is rich in iron and aluminium salts, but poor in calcium, magnesium, sodium and potassium(Cole,1954). The calcium deficiency was noted early in the history of white settlement in Kenya, and various ills were attributed to it, even such diseases as acute appendicitis.

The crops grown by the Kikuyu have changed since the tribe first came into contact with the other immigrant civilisations. This change is of great significance from a nutritional point of view, and Table XVI is an attempt to distinguish the older and the newer species. The distinction in time between the cultivation of the species is not a rigid one. If we were to visit any market in Kikuyuland to-day we would still find specimens of the older crops offered for sale, but in general it is true to say that the emphasis is on the cultivation of the species shown in the right-hand column of the table. The reasons for the change are as follows: In the first place, the mealy bug has almost destroyed the yam and the pigeon pea. In the second place, the newer crops tend to have a greater cash value on the export market, and in the third place the newer crops are those which tend to grow more easily and need less care than the older ones. Thus millet needs much more care than maize does and so maize came to be preferred to millet.

TYPE	OLDER SPECIES	NEWER SPECIES
Cereals	Millet (various species)	White maize (*Zea mays*)
	Kaffircorn (*Sorghum* species)	
Legumes	Dolichos bean(njahi) (*Dolichos lablab*)	Kidney bean(mboco) (*Phaseolus vulgaris*)
	Pigeon pea (*Cajanus cajan*)	
	Cowpea (*Vigna ungiuculata*)	
Roots	Sweet potato (*Ipomoea batatus*)	Irish potato (*Solanum tuberosum*)
	Yam (*Dioscorea* species)	
	Arrowroot (*Maranta arundinacea*)	
Fruits	Banana (*Musa sapientum*)	Banana
	Plantain (*Musa paradisiaca*)	Plantain

Table XVI. Comparison of older and newer crops grown in Kikuyuland.

The origins of the different species of food plants now grown in Kikuyuland are of interest, and are set out in Table XVII. This table is based on a study made by Greenway(1944). It is of interest to note, what we might have expected, that the species formerly most popular

were mostly indigenous to Africa. The two exceptions to this were the Dolichos bean and the sweet potato. The Dolichos bean came from Asia and reached Africa in the eighth century A.D. according to one authority, and so may be held to have some claim to antiquity in Africa (Greenway,1944). The sweet potato was brought to Europe by Columbus, and then was probably taken to West Africa by the Portuguese, from whence it spread across to the east.

TYPES	SPECIES	ORIGIN
Cereals	Millet	Africa
	Sorghum	Africa
	Maize	Mexico
Legumes	Dolichos	Asia
	Pigeon pea	Africa
	Cowpea	Africa
	Kidney bean	Central America
Roots	Sweet potato	Central America
	Yam	Africa
	Arrowroot	Africa
	Irish potato	South America
Fruit	Banana & plantain	Malaysia

Table XVII. Origin of Kikuyu food plants.

The change in crops shown in Table XVI has had a definite effect on the nutrition of the people, and in general that effect has been adverse. In most cases the newer crops had lower nutritional values than the older ones. This is shown in Table XVIII which is a comparison of the food value of sorghum with that of maize, and of the sweet potato with that of the Irish potato. The figures are derived from Platt(1945) and are expressed in amounts per 100 g. of edible portion.

FOOD FACTOR	WHOLE SORGHUM	WHOLE MAIZE	SWEET POTATO	IRISH POTATO
Calories	356	349	121	82
Fat(g.)	3.4	4.5	1	0
Carbohydrate	67 g.	71	26	18.4
Calcium(Mg.)	32	12	20	10
Iron(mg.)	6.6	5	0.7	0.7
Thiamine(mg.)	0.6	0.3	0.1	0.1
Niacin(mg.)	3.5	1.5	0.7	1.0
Ascorbic acid	0	0	20 mg.	15
Waste(%)	10	25	15	15

Table XVIII. Comparison of food value of certain Kikuyu food plants.

Maize is such an important part of the Kikuyu diet that it is worth a little more consideration. It is

usually believed that white maize was introduced to East Africa by the Portuguese in the seventeenth century, but it is probable that it did not penetrate to the interior until much later. Gregory(1896) mentions that he saw maize growing in Kikuyuland in 1895, and this appears to be the earliest reference that we have. Maize has the great attraction of growing under almost any kind of conditions, and needing little care apart from weeding during its growth. These properties together with the export demand for it, determined the ascendancy of maize over millet and the sorghums. Maize shares with the other sources of vegetable protein a deficiency in the amino-acids lysine and methionine, both of which are essential for the body.

Other crops which are grown include sugar cane (Saccharum officinarum) which is chiefly used to make Kikuyu beer. The use of arrowroot is decreasing. The cultivation of vegetables used by the European is on the increase, but chiefly for their cash return.

The other source of foodstuffs is livestock of various kinds, but the Kikuyu traditionally made little use of his livestock as a source of food. Goats and sheep were the earliest form of livestock introduced to Kikuyuland, whilst cattle were brought in much later. Livestock represented the wealth of the Kikuyu and as such were not readily killed for food. In older times goats and sheep were sacrificed for various reasons in the Kikuyu animistic religious practices and afterwards the meat of the carcase was eaten by the men. Cattle

and goats were often eaten when they had died from natural causes(Middleton,1953), and since the cause of death was often anthrax, this practice commonly led to an outbreak of intestinal anthrax. From time to time a group of men would buy an ox or cow, or give one as a present, and they would kill it in the bush and skin it and cut it up. They would then roast the meat and then stay with the carcase until all was eaten. This was called an ikari or meat feast, and would generally last for some days. In tribal life there were various occasions on which meat feasts might be held, but it is worth noting that it is the men who ate the meat, not the women. The Kikuyu never ate the meat of wild game, nor did they ever catch fish to eat. To-day, the meat of cattle, sheep and goats forms a not inconsiderable part of the diet of the people, and the women too are beginning to eat meat. This is shown by the fact that 30 per cent. of our cases of taeniasis saginata are women, and that 38 per cent. of the cases of intestinal anthrax were found in women.

Cattle and goats produce milk, but this was not commonly drunk by the Kikuyu. They said that drinking milk caused tapeworm infestation(Barlow,1924), or in the case of women produced sterility. In 1955, the distribution of milk by the British Red Cross to malnourished Kikuyu led to widespread rumours that it produced sterility. In olden times the Kikuyu cattle did not produce much milk, and what was produced was drunk sour by the men. To-day, the Kikuyu prefer to sell the milk

rather than to drink it or to give it to their children to drink. This is one illustration of the fact that often amongst African peoples, malnutrition is not due to the lack of the proper foods, but to the neglect of what is available.

Fowls were not kept by the Kikuyu in former times for the very good reason that the crowing of the cocks would betray the location of their homesteads to any Masai raiders who happened to be in the vicinity. To-day they keep hens but do not make any special effort to feed them, and so they get hardy birds which produce only very small eggs. As in the case of milk, they prefer to sell the eggs rather than eat them. They will, however, bring eggs for patients in hospital when asked to do so.

Honey is a popular food with the Kikuyu. They gather it from primitive bee-hives made from hollowed-out tree trunks which are placed in the branches of trees. They eat it in the form in which it is gathered without attempting to purify it, or they use it to make a very potent alcoholic drink.

We have now completed our brief survey of the foodstuffs used by the Kikuyu, and it remains to see how they are prepared and eaten. The most important food value to a Kikuyu is the satiety value. It is truly remarkable how much food a Kikuyu youth or adult can eat at one meal. When Kikuyu students are sent to Britain for higher education they always complain about the small meals they are given, but after the first week or so the

stomach wall adjusts itself to the smaller volume of food and regains its tone.

Traditionally the only set meal of the Kikuyu was eaten in the evening. Preparations began about 4 p.m. which was called the mirugia aka or the time when the women begin to cook. The meal itself was eaten about 6 p.m. in the compound of the homestead in front of the huts. The crockery was composed of calabashes cut in half longitudinally. There was no cutlery normally, but a hunting knife might be used to cut meat if this was required. The remains of the evening meal were kept overnight and eaten about 7 a.m. on the following morning. If there were no remains, then the morning meal consisted simply of a quantity of thin maize gruel. In those families which have been in contact with the ways of the European there is now a tendency to adopt the meal-times familiar in Europe. In general, the big meal of the day is eaten in the evening.

The two basic forms of Kikuyu food are ucuru or maize meal gruel, and irio or a thick stodgy porridge to which various foodstuffs may be added. Ucuru is a drink rather than a food, and taken by the Kikuyu in preference to plain water. It is made by mixing maize meal with water, about one part to three. It is then heated in an earthenware pot on the fire, but is not brought to the boil. Then it is kept for two days in large calabashes, and drunk cold.

Irio is made as described by Procter(1926). Whole maize is mixed with an equal quantity of beans and the

mixture is then boiled for about two hours. Meanwhile plantains are peeled, boiled and then mashed. When the maize and bean mixture is ready some salt is added and then the mashed plantains, and the whole mixture stirred up until it is of the consistence of a firm dough. This is now dished out in half calabashes and eaten with the fingers. To this irio other things may be added. The women often added green leaves to theirs. The men were not allowed to eat green leaves because it was believed that to do so would prevent them from being fleet of foot if defeated in battle by the Masai(Orr & Gilks,1931).

Maize was also eaten roasted on the cob. Yams, sweet potatoes and other roots were either boiled or roasted whole, and then eaten.

Orr and Gilks(1931) analysed the daily consumption of irio in their report. They distinguished "common irio" which was eaten by the men, and "women's irio" which was common irio to which green leaves and more plantains had been added. The daily consumption of irio was composed of the following:

	COMMON IRIO	WOMEN'S IRIO
Maize	336 g.	336 g.
Beans	161 g.	156 g.
Plantains	231 g.	565 g.
Green leaves	0	166 g.
Salt	0.9 g.	4.7 g.

This daily amount of food was then analysed by a biochemist who obtained the values given in Table XIX.

CONSTITUENTS	COMMON IRIO	WOMEN'S IRIO
Protein	60 g.	82 g.
Fat	6 g.	8 g.
Carbohydrate	142 g.	217 g.
Calcium	0.21 g.	1.86 g.
Phosphorus	1.9 g.	2.19 g.
Sodium	0.45 g.	1.56 g.
Calories	862	1,268

Table XIX. Analysis of amount of irio consumed daily.

This table takes no account of the maize gruel which is drunk during the day, and which is a good source of carbohydrate and calories. Otherwise it may be taken as representing the average daily intake of food by a Kikuyu adult.

Infants are often kept on the breast until they are almost two years old, though some mothers say that they stop breast feeding after the first four teeth have appeared, which is about the age of nine months. Weaning begins early, and I have seen mothers stuffing bananas into the mouth of children only a few weeks old. In general, weaning begins about four to six months when yams and bananas are pre-masticated by the mother and then placed in the child's mouth and it is given maize gruel to drink. No special ante-natal feeding

is practised generally, though in some districts the women prefer to eat millet and foods rich in calcium during pregnancy. After they are delivered the women are given a goat by their husband which is killed and cooked. They then eat the meat of this goat over the following four or five days. In former times this would be all the animal protein they would be given, but to-day this custom is not followed and the women are allowed to eat more meat to maintain their protein reserves.

In view of the mainly vegetarian origin of the diet there would appear to be an adequate amount of roughage in it. My clinical impression is that most Kikuyu do not drink the optimum amount of fluid each day, but this needs further investigation. Also, my impression is that the normal daily output of urine falls below the fifty ounces given in European textbooks, and this figure needs checking for Africans. This may not be easy to do because the African always suspects some underlying motive for such clinical tests. A biochemist in Nairobi once wanted some human urine for sex hormone investigations and he asked the boys of a senior African secondary school to co-operate, but all refused to pass urine into the receptacle he provided, and gave no reasonable explanation.

Let us now try to summarise the deficiencies which appear to exist in the Kikuyu diet. This diet is deficient in the following substances:

1. First-class protein
2. Fat
3. Calcium

4. Niacin

5. Carotene.

In view of the vegetarian character of the diet, the main source of protein is in the legumes. Vegetable protein is usually deficient in the essential amino-acids lysine and methionine. For this reason it is widely held that vegetable protein is inferior in nutritional value to animal protein, but Dean(1954)* points out that this is not finally proved. Certainly his use of vegetable protein in the treatment of kwashiorkor gave results almost as good as those given by milk protein(Dean,1952). Nevertheless, the existence of such syndromes as that of kwashiorkor amongst the Kikuyu is evidence of protein malnutrition. Not that the protein is not available, but that it is not consumed.

The daily intake of fat is extremely low. An average value would be less than 10 grammes per diem. Most of the body fat must be synthesised from the dietary carbohydrate. Himsworth(1935) found that a low fat intake combined with a high carbohydrate intake was frequently associated with a low incidence of diabetes mellitus. This is certainly true of the Kikuyu.

The calcium deficiency in the food is quite marked in the case of the common irio. The daily intake is 0.2 gramme, whilst the recommended intake (for Europeans) is 0.8 grammes. The women's irio contains more than twice the recommended daily intake. The high level of phosphorus contained in the diet will further reduce the calcium absorption since it has been found that an

* In Trowell, Davies and Dean (1954).

increased amount of phosphorus in the diet means decreased absorption of calcium from the lumen of the intestine. The deficiency cannot however be a very severe one for it is very rare to see a case of acute florid rickets in a Kikuyu. Orr and Gilks(1931) claimed to have found signs of late rickets in 63 per cent. of 1,325 boys they examined in Kikuyuland, but no signs of early rickets. This sounds rather odd, and they go on to admit that some of the bony changes they attributed to rickets may, in fact, have been due to yaws. Philip(1943) suggests that calcium deficiency is responsible for the stunting of the tribe, that because of this deficiency the bones are shorter and thinner.

There is no deficiency of iron in the Kikuyu high-cereal diet because the cereals and legumes contain a plentiful supply of iron. Foy and Kondi(1952) say that "speaking generally, in the diet of the African an intake of iron less than the recommended allowance is well-nigh impossible to attain."

It is appropriate here to mention the occurrence of flourine in the water of South Nyeri District. The water supply at Tumutumu was found to contain 0.15 parts per million of fluorine, a value far below the critical level of 1.5 parts per million at which dental fluorosis occurs. Even so, Williamson(1953) records the severe type of dental fluorosis at Tumutumu, as well as at the following places in South Nyeri District: Nyeri Township, Aguthi, Kirimukuyu, Gikondi, Mathari and Hombe. The exact incidence of the syndrome is not known.

The niacin deficiency reflects the small amount of this substance in maize. In spite of this deficiency pellagra is uncommon in Kikuyuland. It has appeared recently amongst Kikuyu prisoners whose dietary niacin content was adequate for ordinary activity but inadequate for the calorie intake required for heavy manual work.

Maize is also deficient in carotene, and this along with the low fat intake means an inadequate intake of vitamin A, which is reflected in the common occurrence of phrynoderma in the Kikuyu.

What are some of the results of these dietary deficiencies and dietary habits of the Kikuyu people ? Jelliffe(1952) blames dietary deficiency for the low birth weight of the African child. Trowell, Davies and Dean(1954) point out that tuberculosis is more common where diets are deficient. Tropical ulcer is also associated with a defective diet, and they say that pyomyositis is limited to areas where protein malnutrition is common. Calcium and protein deficiency produce a thin and stunted people(Philip,1943). The large cereal meals of the African peoples stretch the muscles of the abdominal wall and tend to produce herniae. The inguinal type is the most common and may be partly due to this cause, and partly to the influence of oestrogens referred to above. The intestinal supports are stretched by the bulky meals and are lax and weak, and this may explain the common occurrence of intussusception and intestinal volvulus (Burkitt,1952). The most important result of protein malnutrition is the damage to the liver which is first

seen in infancy or early childhood as part of the syndrome of kwashiorkor. This will be referred to in more detail in a later section.

TRAINING:

The old Kikuyu belief was that disease was outwith human control. Sickness was due to the spirits of the malicious dead, the curse of a dying parent or the influence of the evil eye(Barlow,1924). Only a medicine man could determine the cause of disease and how it was to be treated. The Kikuyu mind did not analyse disease situations in terms of cause and effect, but for the most part accepted the word of the medicine man. The result was that no effective measures were taken to prevent the spread of disease. The same fatalism as characterised his thoughts about disease, was seen in his attitude to death. It was accepted and dismissed as the uhoro wa Ngai, the will of God.

The belief in thahu or ceremonial uncleanness also influenced the incidence of disease and death. Thahu deprived the Kikuyu of two excellent sources of animal protein, namely game birds and fish. To eat either of these was to become thahu, and it cost at least a goat to be made clean again by the medicine man. We have already seen how the building of better huts was prevented by thahu. Because of thahu no Kikuyu would ever go to the aid of a dying man for to touch a dead body was to become thahu. In some cases thahu worked the other way. Thus to wound a person was to become thahu.

Also, a woman who allowed her child to fall off her back became thahu, which was an added incentive to her to see that it was securely fastened on to her back.

The attitude of the husband to his wife and children is a factor which may often cause delay in getting them to hospital, and even contribute to a fatal outcome. They cannot be admitted to hospital unless they have the permission of their "owner", i.e. their husband or father. Often they feel that they may not leave their homestead to come to hospital if the husband is away from home. Or they may come to hospital but will not agree to be admitted because they do not have his permission. It is obvious that in some cases great delay can occur before an acute emergency can be admitted for treatment.

The habits of the Kikuyu people contribute towards the occurrence and persistence of disease amongst them. The absence of sanitation has already been referred to. They have little idea of isolation of infectious cases. Spitting on the ground is allowed, though inside the hut it is usually done into the fire. In older times the people did not wash themselves regularly. The younger people might wash themselves in the river daily or twice weekly, but the older ones commonly went for a month or more without washing their bodies, or even their hands. Clothes were very infrequently washed. The old skin garments were never washed, and the more modern clothes and blankets are not often washed, except by the more educated families.

THE FACTORS WHICH MAY INFLUENCE THE RELIABILITY OF THE STATISTICS.

We must now take note of those factors which may have influenced the reliability of the statistics which we are to present in the succeeding pages of this study. These factors are of three kinds: Those which may have influenced the attendance of the sick at a medical institution; those which may have influenced the diagnosis of disease in such an institution; and, finally, those factors which may have influenced the assessment of the age of individual patients.

There are many factors which may have influenced the attendance of patients at medical institutions in South Nyeri District during the ten years of this study. We may list them as follows:

1. The ability to recognise the benefits of Western medicine.
2. The existence of fee-paying and non-fee-paying institutions.
3. The opening of the Consolata Hospital in 1946.
4. The season of the year.
5. The second world war.
6. The state of emergency.

The benefits of Western medicine were first brought to the Kikuyu of South Nyeri District in 1910 when the

first European doctor to practise in the district began work at Tumutumu. Since that time the Kikuyu have seen the results of the prevention and treatment of the diseases which have afflicted them. They have had many practical proofs of the effectiveness of European medicine, notably the almost complete eradication of yaws. It may be assumed, therefore, that except for the old people, there are few who would be held back from seeking medical aid by a disbelief in the advantages of European medicine. Even so, it is obvious in many cases who do come that they have first consulted the medicine man, for they often come with the signs of his cupping and incisions upon them.

The existence of both fee-paying and non-fee-paying institutions in the same district may result in the selection of patients. Attendances at a medical station which charges fees, may thus differ in number and in type from those at a free institution. It may be that neither type of institution can be used as a fully representative sample of the morbidity of the district. It is obvious from the figures which will be given in a later section that far more patients attend the free institutions, than attend where fees are charged. Whether the disease pattern differs between the two kinds of institutions can only be known by a detailed analysis of the books and case-records from these institutions. Such an analysis is not attempted here. For the purposes of this study I have assumed that the records of a fee-paying institution are typical of the

district as a whole, and can only hope that I have been able to obtain a large enough sample to ensure that this might be so.

It was in 1946 that the Consolata Hospital at Mathari was re-opened. Immediately the number of sick seen at medical centres rose. This raises an interesting problem: Was this a real increase in sickness in the district, or had this amount of sickness always existed but the people had not sought medical aid because of the lack of facilities ? The latter explanation would seem to be the correct one, but it raises the further problem as to what happened to the sick before more medical stations were opened. They must have stayed at home and have been looked after by their own people.

The season of the year has some influence on the attendance of patients at hospital. We shall discuss this in more detail when we consider the seasonal distribution of outpatient attendances. One seasonal phenomenon is well-recognised in Kikuyu country, and that is the effect of the planting and tending of the crops. During the short planting season the hospital empties for the women are reluctant to be admitted for treatment, and during the weeding which follows the outpatient attendances fall (see Figure 13).

The second world war took away some of the young men for work in the Pioneer Corps in Kenya and in the Middle East countries. I have been unable to obtain a definite figure from the District Commissioner's office of how many were recruited in this way, and so I have

had to neglect this factor in presenting the statistics. The error is not likely to be a great one so far as the figures for the total population are concerned since these are worked out from the 1948 census figures, by which year most of the young men had been demobilised. The error will chiefly affect the actual attendances at the medical stations, and so it may be that the total sick figures are underestimates for the years during which this factor was operative, i.e. 1944 to 1947.

In October 1952 a state of emergency was declared to exist in Kenya as a result of the uprising of the Mau Mau movment, and this had some influence on the population figures and on attendances at medical stations. It reduced the size of the population because numbers of people were arrested and removed to detention camps. On the other hand, there was an increase in the population due to the influx of Kikuyu farm-workers from the Rift Valley Province, who were returned to their reserve as a security measure in 1953. I have been unable to obtain a trustworthy figure for these population changes, and I have had to assume that they cancelled each other out. If this is so, it cannot be exactly so, because the immigrants from the Rift Valley came in families, whilst the detainees went as individuals, chiefly males. It should be noted, however, that this factor affects the year 1953 only and not the previous years of the decade.

The factors which may influence the diagnosis of disease in this study are two in number. The first is

the keenness and interests of the doctors concerned. The fact that there have been several changes of doctors during the decade of our review may have had some influence on the diagnosis of the diseases in our series. During the ten years 1944 to 1953 there were five doctors at Nyeri Hospital, five at Tumutumu Hospital, and two at the Consolata Hospital. It would be impossible to assess the influence of this factor without analysing the interests of the doctors concerned, and this is not possible since some of them are no longer available. This factor, therefore, has had to be neglected.

The second factor is the availability of diagnostic aids, especially a microscope and simple laboratory apparatus. In most cases the doctor has had to depend on the skill of his laboratory technician in microscopic diagnosis, and this skill may not always be reliable. Once when I checked up on the diagnosis of a purulent meningitis which had been reported as meningococcal, I found that the laboratory technician at Tumutumu Hospital could not distinguish pneumococci from meningococci. This will explain why all cases of purulent meningitis in this series are treated together, and not distinguished bacteriologically. To attempt to distinguish them in this way would be misleading because the bacteriological diagnosis was unreliable in most cases.

Age assessment in Africans is always a difficult task. The ages given in this series are based on the experience of the senior African hospital assistant who has been in charge of the outpatient department at

Tumutumu Hospital since he completed his training in 1915. He assesses the age of the patient as he fills in the details on the case sheet before the patient is admitted to the hospital. In many cases he can remember when they were born, and in other he makes a guess which is usually fairly accurate, and certainly accurate enough for the age categories used in this study.

SECTION IV. ANALYSIS OF MORBIDITY BY INCIDENCE.

1. Total sick-rate of South Nyeri District.

2. Outpatient statistics.

3. Inpatient statistics.

THE TOTAL SICK-RATE OF SOUTH NYERI DISTRICT

The total numbers of sick people who attended medical institutions in South Nyeri District during the ten years from 1944 to 1953 are given in Table XX. In the last column of the table they are represented as a percentage of the total population for the year.

YEAR	TOTAL SICK	PERCENTAGE OF POPULATION
1944	64,012	38.1
1945	62,362	36.1
1946	68,083	38.7
1947	107,068	59.6
1948	115,963	63.6
1949	112,451	60.2
1950	104,570	54.9
1951	104,224	53.6
1952	94,481	47.7
1953	117,334	58.1

Table XX. Annual morbidity of South Nyeri District.

The low percentage sick-rates before 1947 are quite striking. The reason for these was that the Consolata Hospital only re-opened late in 1946 when the Italian

medical officer was released from internment. Another year which shows a low sick-rate is 1952. This is explained by the declaration of the state of emergency in October of that year. With this declaration, all African transport was immobilised and patients could not travel to hospital or dispensary. Also the presence of troops throughout the district made people reluctant to move away from their homes in case they were mistaken for Mau Mau terrorists. The main effect of the emergency was on the numbers of maternity patients coming to hospital. These numbers showed a marked fall, but they are not included in the figures given in the table.

In working out the average annual sick-rate we have neglected the years 1944 to 1946, and the year 1952. The average annual sick-rate for the remaining six years is 58.3 per cent.. It is worth noting that in 1948 when the total population figures were the most reliable because the census was taken in that year, the sick-rate was also the highest, namely 63.3 per cent.. In any year, therefore, at least half the population are ill enough to seek medical aid at either a hospital or a dispensary.

In a previous section we mentioned the effect of climate on the incidence of disease. In Table XXI the coefficient of correlation is worked out for the percentage sick-rate and the climatic data given in Table XI above.

ANNUAL MEAN VALUE	PERCENTAGE SICK RATE
Temperature	- 0.53
Rel. humidity	+ 0.01
Rainfall	+ 0.23
Cloud amount	- 0.20

Table XXI. Coeffieients of correlation of annual climatic data and annual percentage sick rate.

It should be noted that for the purposes of calculating the coefficients of correlation for the above table, the percentage sick rate for the years 1944 to 1946 was corrected on a proportionate basis using the figures of the following years of the decade. Thus instead of the figures given for these years in Table XX, the following were used:

1944	43.6%
1945	41.3%
1946	44.3%.

The closest correlation is between the mean annual temperature and the percentage sick-rate. The relationship is an inverse one as might have been expected. It is surprising that there is little correlation between the mean relative humidity and the percentage sick-rate. The fact that there is not a greater degree of correlation suggests that there are other factors at work influencing the sick-rate. It will be more profitable to discuss

these factors separately for inpatients and outpatients, both for total sick-rates and for individual diseases. This we shall do in later sections, but it may be said here in anticipation of what follows, that the data which are available are neither adequate enough nor accurate enough to allow any firm conclusions to be drawn from them. Such conclusions must await further development and organisation of the Kikuyu country and the reliable provision of vital statistics.

It must be emphasised too that in this and succeeding sections we are concerned with consultation sickness rates and not sickness rates which are a true guide to the actual incidence of sickness in the community. Our figures are of those persons who sought medical aid or advice at a medical station, and do not include those whose illness was trivial and did not come for treatment; nor those who refused to come for medical aid; nor do they include those who were too ill to come by themselves and whose relatives refused to bring them. Therefore the figures given in Table XX for the total annual morbidity of South Nyeri District over the decade under review are an underestimate of the real amount of sickness which existed in the district during that period. But we have no other data and it is impossible to determine the difference between the consultation sickness rate and the true sickness rate on the data we have. The further data needed could only be obtained by a Survey of Sickness such as is carried out in England and Wales, and which would not be easy to do in a primitive community.

OUTPATIENT STATISTICS FOR SOUTH NYERI DISTRICT

The total sick figures considered in the last section are made up of the outpatient and inpatient figures, and we now proceed to consider these separately.

The outpatient figures given in the hospital and dispensary returns are the numbers of attendances paid to these institutions by sick people. There is no indication how many sick individuals made these attendances. For the purposes of this study it is important to know how many sick people are represented by these total attendances. In order to obtain this information a sample of 592 people who attended Tumutumu Hospital outpatient department in January 1955 was asked how many times they had attended any medical institution during 1954. The results are given in Table XXII.

ATTENDANCES IN 1954	MALES	FEMALES	TOTAL PATIENTS	TOTAL ATTENDANCES
1	89	170	259	259
2	55	98	153	306
3	45	50	95	285
4	17	32	49	196
5	8	16	24	120
6	3	9	12	72
TOTAL	217	375	592	1,238

Table XXII. Number of attendances paid by outpatients to medical institutions in 1954.

This table is of interest in itself in revealing how often a representative sample of the people reports sick each year. For our purposes, however, we can derive from it a fraction with which we can correct the number of outpatient attendances, and so derive an estimate of the number of sick persons involved. This was done by multiplying the attendances by the fraction 592/1238, and the result is given in Table XXIII.

YEAR	TOTAL OUTPATIENTS	PERCENTAGE OF TOTAL SICK	PERCENTAGE OF TOTAL POPULATION
1944	55,519	86.8	33.0
1945	52,734	84.6	30.6
1946	56,394	82.9	32.1
1947	94,495	88.3	52.5
1948	103,286	89.1	56.4
1949	99,225	88.2	53.1
1950	92,121	88.1	48.4
1951	91,120	88.2	47.3
1952	85,289	90.3	43.1
1953	108,531	92.5	54.0

Table XXIII. Total number of persons who attended outpatient institutions in South Nyeri District 1944-1953.

The remarks already made on the years 1944 to 1946 and on 1952 with regard to the total sick figures apply

to the outpatient sick rate also. For the purposes of calculating the average number of outpatients who visited an outpatient department each year we are confined to the six years 1947 to 1951 and 1953. This figure in terms of the percentage of the population was 51.9 per cent.

In order to correlate the morbidity amongst these outpatients we must now take note of the number of first visits they paid and relate these to the climatic data for the years concerned. Table XXIV sets forth the total number of first visits paid by outpatients over the ten years of this study.

YEAR	FIRST VISITS
1944	117,102
1945	110,089
1946	119,140
1947	197,716
1948	215,993
1949	207,500
1950	194,739
1951	192,218
1952	178,363
1953	226,972

Table XXIV. Annual number of outpatient first visits.

The figures for the years 1944 to 1946 given in Table XXIV were corrected on a proportionate basis as in the case of the total sick-rate figures in order to compensate for the absence of the Roman Catholic medical stations. The corrected figures were used for the calculation of the coefficients of correlation and were as follows:

1944	133,952
1945	125,919
1946	136,270.

The relationship of the annual number of outpatient first visits to the climatic data is shown in Table XXV and in Figure 12.

ANNUAL MEAN VALUE	FIRST VISITS PAID
Temperature	- 0.76
Rel. humidity	+ 0.18
Rainfall	+ 0.28
Cloud amount	- 0.01

Table XXV. Coefficients of correlation of annual climatic data and total number of first visits paid annually by outpatients.

The correlation of the mean annual temperature with the annual first visits by outpatients is quite clear cut. The lower the temperature the higher is the number of attendances at medical stations in the district.

No estimate of the age structure of the outpatient population is possible as these details were not given in the outpatient records. An estimate of the sex distribution of first visits paid is possible for both Nyeri and Tumutumu Hospitals. The sex incidence amongst outpatient first visits for the five years mentioned in the case of Nyeri Hospital was as follows:

YEAR	MALE	FEMALE
1944	65.7%	34.3%
1945	67.2%	32.8%
1949	61.0%	39.0%
1950	56.1%	43.9%
1951	58.0%	42.0%
AVERAGE	61.6%	38.4%

The sex incidence amongst outpatient first visits at Tumutumu Hospital shows rather a different pattern, and is as follows for the three years for which records are available:

YEAR	MALE	FEMALE
1951	36.5%	63.5%
1952	34.5%	65.5%
1953	49.0%	51.0%
AVERAGE	40.0%	60.0%

Nyeri Hospital serves a township and an area where European farms predominate. The labour employed on these farms is chiefly male labour, and this may account for the male preponderance amongst the outpatients seen at the

hospital. Tumutumu Hospital, on the other hand, serves a rural population and there the female incidence amongst the outpatient first visits is greater than the male.

The average monthly attendance at the outpatient departments of the three hospitals in South Nyeri District is given in Table XXVI below. The figures are those of first visits and do not represent the number of persons involved since, as we saw in Table XXII, one person may pay more than one visit during the year if he suffers from further illnesses.

MONTH	CONSOLATA	TUMUTUMU	NYERI
JANUARY	571	755	3,393
FEBRUARY	518	691	3,101
MARCH	567	759	3,889
APRIL	545	677	3,496
MAY	486	813	3,482
JUNE	505	874	3,656
JULY	490	799	3,550
AUGUST	416	720	3,317
SEPTEMBER	453	683	3,551
OCTOBER	490	753	3,515
NOVEMBER	483	684	3,551
DECEMBER	476	767	3,279

Table XXVI. Average monthly attendances at hospital outpatient departments for years 1947 to 1951.

In Table XXVII similar figures are given for first visits to the dispensaries of the three medical agencies operating in South Nyeri District. The figures given are the monthly average for each dispensary of the particular group.

MONTH	C.C.M.	C.S.M.	G.M.D.
JANUARY	184	241	1,462
FEBRUARY	166	217	1,378
MARCH	195	253	1,357
APRIL	186	239	1,313
MAY	214	237	1,349
JUNE	210	226	1,476
JULY	189	208	1,340
AUGUST	178	210	1,312
SEPTEMBER	196	196	1,280
OCTOBER	196	205	1,405
NOVEMBER	205	206	1,494
DECEMBER	190	224	1,420

Table XXVII. Average monthly attendance at dispensaries of the three medical agencies in South Nyeri District.

It is at once obvious from a comparison of Tables XXVI and XXVII that patients prefer to attend a hospital outpatient department rather than a dispensary. The ratio of attendances at such departments to those at the dispensaries is approximately three to one. This is only to be expected for the hospital outpatient department usually provides greater facilities than the dispensary, and there is always the possibility of being seen by the European doctor. Another fact which emerges from the comparison is that patients prefer to attend a free institution rather than one where fees are charged. Again the ratio is roughly one to three in favour of the free institution. If the figures given in Tables XXVI and XXVII are added together for each month and divided by six the result given in Table XXVIII is obtained.

MONTH	ATTENDANCE	MONTH	ATTENDANCE
JANUARY	1,101	JULY	1,096
FEBRUARY	1,012	AUGUST	1,009
MARCH	1,170	SEPTEMBER	1,059
APRIL	1,076	OCTOBER	1,094
MAY	1,097	NOVEMBER	1,104
JUNE	1,158	DECEMBER	1,059

Table XXVIII. Average monthly outpatient attendance at medical institutions in South Nyeri District.

There is not much variation in the figures given in Table XXVIII, but such variation as there is is significant. If we apply Fisher's Chi squared test we find that the value for P is 0.01, and this means that the variation is very significant. The most obvious factors which might explain the variation are the climatic ones and these are correlated with the number of first visits in Table XXIX.

MONTHLY MEAN VALUE	FIRST VISITS PAID
Temperature	+ 0.20
Rel. humidity	- 0.05
Rainfall	+ 0.08
Cloud amount	+ 0.01

Table XXIX. Coefficients of correlation of monthly climatic data and the average number of first visits paid by outpatients at each medical station.

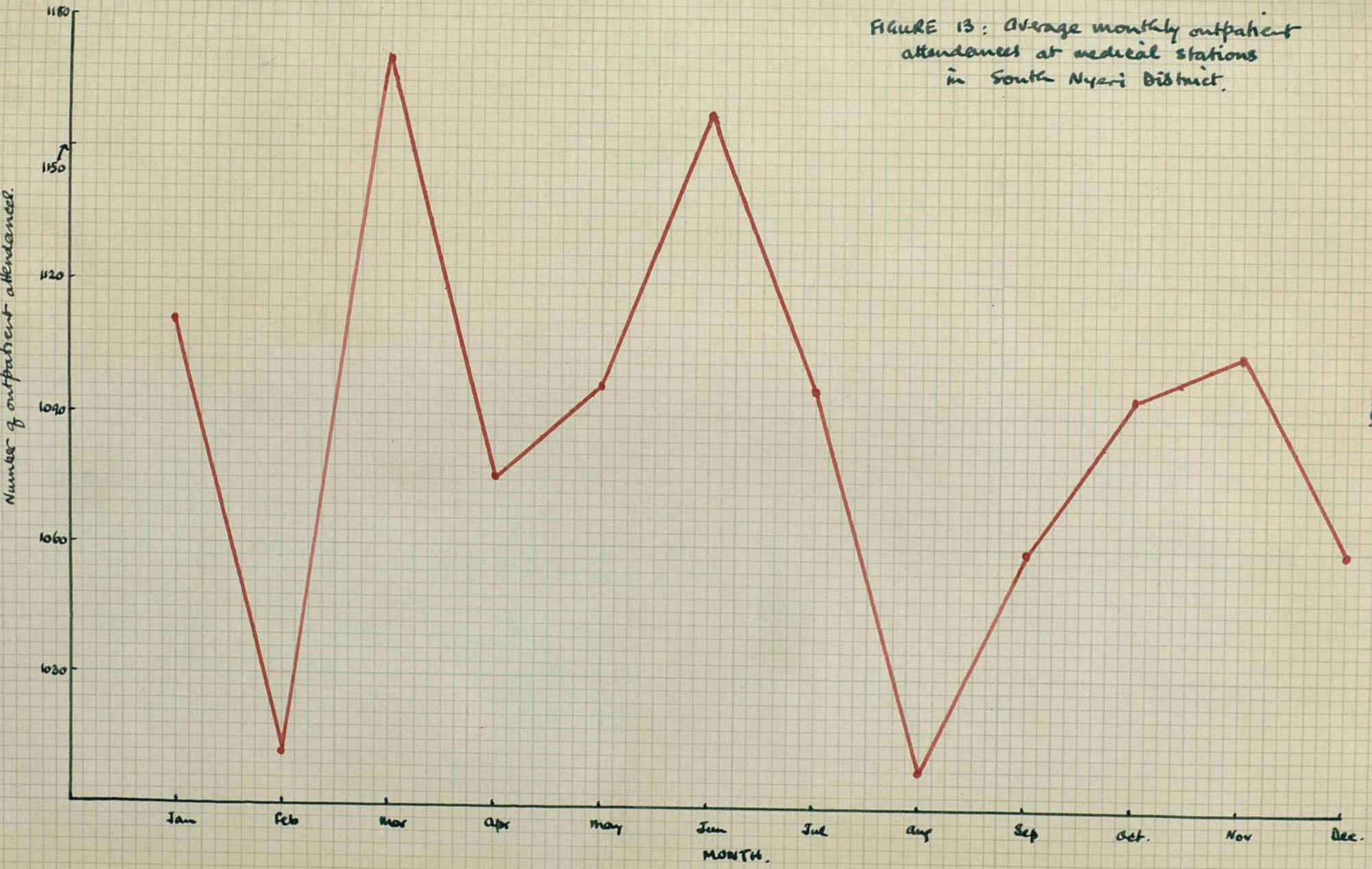
The table shows no significant correlation between the outpatient attendances and the climatic data. This is rather surprising in view of the relationship already found between the mean temperature and the annual outpatient attendances as shown in Table XXV. Can we find any significant factors which might explain the monthly variations in outpatient attendances ? We think so, although it is difficult to give certain proof.

We suggest the following explanations of the rise and fall in numbers of outpatient attendances.* The fall in February may be related to the fine sunny weather which is characteristic of the first two months of the year. The rise in March precedes the onset of the long rains when the food gathered in the previous harvest season is beginning to run short and the signs of malnutrition are beginning to appear, and so it may be that the explanation of this increase is a nutritional one. The relative fall in numbers in April and May is a well-recognised phenomenon whose explanation is clear. These are the two months of vital importance for the planting and weeding of the cereal crops on which the people depend so largely for their food. At this time they cannot afford to be ill, and will only report sick when they are obliged to with some serious illness or injury. The rise in June when the rains are virtually over is explained by their now being able to report again for minor sickness, but this is also the month when malaria admissions are most numerous as we can see from Figure 46. At this time the seasonal incidence of malaria is maximal following the long rainy season and this increases the amount of sickness at this time. The fall in numbers in August is more difficult to explain for this is one of the misty months when sickness might have been expected to increase rather than to decrease.

We have now considered the number of person who attended the South Nyeri medical stations and hospitals, and

*See Figure 13 on page 103.

FIGURE 13: Average monthly outpatient attendances at medical stations in South Nyeri District.



also the number of first visits they paid to these stations, Which is the same as the number of diseases for which they sought medical aid. It remains now to discover how many visits they paid for each disease on the average. Table XXX gives the average number of attendances for each disease at the hospital outpatient department and dispensaries of two of the medical agencies in the district.

YEAR	CH. of SCOT. MISSION		GOVT. MED. DEP.	
	HOSPITAL	DISPENSARY	HOSPITAL	DISPENSARY
1944	4.2	4.6	1.8	1.8
1945	3.8	4.3	1.3	1.7
1946	4.7	4.0	1.3	1.6
1947	3.1	3.1	1.4	1.5
1948	2.7	3.0	1.3	1.4
1949	3.1	3.4	1.3	1.1
1950	3.3	3.2	1.3	1.5
1951	2.6	3.3	1.2	1.4
1952	2.5	3.2	1.2	1.5
1953	2.7	3.4	1.3	1.4
AVER.	3.3	3.6	1.3	1.5

Table XXX. Average number of visits paid by each outpatient for each illness or injury during the years 1944 to 1953.

Table XXXI sets out the average number of visits paid for each diseases or injury analysed according to the months of the year. Figures are available for both Tumutumu and Nyeri Hospitals, and for the Church of Scotland Mission Dispensaries. It should be noted that in these figures and in those given in Table XXX the first visit is included in the average figure.

MONTH	CH. of SCOT. HOSPITAL	MISSION DISPENSARY	GOVT. HOSPITAL	AVERAGE
JAN	2.2	3.1	1.3	2.2
FEB	2.5	3.1	1.4	2.3
MAR	3.0	3.0	1.3	2.6
APR	2.8	3.0	1.3	2.4
MAY	2.7	2.8	1.3	2.3
JUN	2.9	3.2	1.3	2.5
JUL	2.9	3.2	1.3	2.5
AUG	3.0	3.2	1.3	2.5
SEP	3.1	3.4	1.2	2.6
OCT	3.2	3.5	1.3	2.6
NOV	3.1	3.2	1.3	2.5
DEC	2.7	3.1	1.2	2.3
AVER.	2.9	3.1	1.3	2.4

Table XXXI. Average number of visits paid by each outpatient for each illness or injury during the months of the year.

Several interesting conclusions can be derived from a perusal of these two tables. First, patients attend longer for each disease at a fee-paying institution than at a free one. There may be several reasons for this. Having paid a fee, they want to be sure they obtain the maximum value for their money and so attend the maximum number of times for each disease. The free institutions are much busier than the fee-paying ones, as we saw in Tables XXVI and XXVII, and therefore would discourage return visits unless they were necessary. The free institutions do not have so ample medical supplies and drugs as the fee-paying ones, and patients return more often to the latter knowing that they will be able to obtain more medicine. It is unlikely that the cases seen at fee-paying institutions are more severe than those seen at the free ones, and this reason may be discounted in explaining the discrepancy in the number of visits paid to each type of institution.

A second conclusion is that outpatients attend longer at a dispensary than they do at the hospital outpatient department. This is true for both free and fee-paying institutions. The reason is obvious for there is a higher standard of diagnosis and treatment in the hospital outpatient department, and a stricter supervision of outpatients, often by a European member of the hospital staff.

A third conclusion is that there is no particular relationship between the number of visits and the year or season. The monthly variation is slight and not related

to the incidence of disease in outpatients as shown by the number of first visits paid. The average annual figure shows a downward trend in the early years of the decade and then becomes more or less steady. This is shown by the following annual average number of visits derived from Table XXX.

YEAR	VISITS	YEAR	VISITS
1944	3.1	1949	2.2
1945	2.8	1950	2.3
1946	2.9	1951	2.1
1947	2.3	1952	2.1
1948	2.1	1953	2.2

INPATIENT STATISTICS FOR SOUTH NYERI DISTRICT

We now proceed to consider the inpatient statistics for the district. These are analysed for the ten years of our study in Table XXXII, and the annual total is also expressed as a percentage of the total sick seen and the total population. The figures are derived from four sources: the three hospitals already mentioned, and from certain Government dispensaries which have beds.

YEAR	TOTAL INPATIENTS	PERCENTAGE OF TOTAL SICK	PERCENTAGE OF TOTAL POPULATION
1944	8,493	13.2	5.1
1945	9,628	15.4	5.5
1946	11,689	17.1	6.6
1947	12,573	11.7	7.1
1948	12,677	10.9	6.9
1949	13,226	11.8	7.1
1950	12,449	11.9	6.5
1951	12,304	11.8	6.3
1952	9,192	9.7	4.6
1953	8,803	7.5	4.1
AVER.	11,103	12.1	5.9

Table XXXII. Total annual inpatient figures for South Nyeri District.

The influence of the fact that the Consolata Hospital did not open until late in the year 1946 is seen again particularly in the figures for the years 1944 and 1945. At the other end of the decade the influence of the state of emergency can be seen even more clearly than in the outpatient figures. Patients would come to the outpatient department for advice and treatment much more readily than they would agree to be admitted to hospital. They might be attacked by terrorists in hospital, and several were and two died as a result. Also we understand that at one period the Mau Mau circulated the rumour that if anyone was admitted to Tumutumu Hospital they would be murdered when they returned home. So far as we know, this threat was never carried out, but it must have discouraged admissions for a time.

The total figures are broken down according to the medical institutions concerned in Table XXXIII. The Government dispensaries which have beds and so are able to keep patients overnight are the following: Karatina, Gakindu and the Police Training School Dispensary. The figures from these dispensaries are given as the total figure of them all. The table shows what we have already noted in the outpatient figures, namely that patients prefer to attend a free institution. This is not only because it is free, but because they have been assured that the Government medical services are paid for out of their annual poll-tax, and they feel that they must see that they get their money's worth.

YEAR	NYERI DISPENSARIES	TUMUTUMU	CONSOLATA
1944	5,908	663	1,922	---
1945	5,228	2,238	2,062	---
1946	5,952	3,342	1,972	423
1947	5,894	3,918	1,760	1,001
1948	6,676	2,766	2,014	1,221
1949	6,250	3,176	2,288	1,512
1950	6,226	1,819	2,556	1,848
1951	6,637	1,382	2,437	1,848
1952	4,589	1,182	1,717	1,704
1953	4,586	1,106	2,033	1,078
AVER.	5,794	2,159	2,076	1,329
RATIO	4.3	1.6	1.6	1.0

Table XXXIII. Analysis of inpatient figures according to medical institutions.

In the case of inpatients, details of age and sex are usually recorded and so it is possible to arrive at an approximate assessment of the sex and age structure of the inpatient population. In the present study this has been worked out from the figures of Tumutumu Hospital inpatients as they were the most readily accessible. The percentage sex incidence amongst the 20,761* inpatients admitted to Tumutumu Hospital over the ten years was as follows: 52 per cent. were males and 48 per cent. were

* This figure does not include maternity admissions.

females. These figures exclude maternity cases for to include these would weight them in favour of the female sex.

The age distribution amongst the Tumutumu Hospital inpatient population over the ten years is given in Table XXXIV below.

AGE GROUP	MALE	FEMALE	TOTAL
0-1	6.7%	6.0%	6.4%
1-4	24.6%	21.4%	23.0%
5-14	21.2%	18.8%	20.0%
15-24	23.4%	27.4%	25.4%
25-34	10.1%	17.8%	13.9%
35-44	6.5%	5.0%	5.8%
45-54	3.7%	2.2%	2.9%
55-64	2.2%	0.8%	1.5%
65-74	0.9%	0.5%	0.7%
75 & over	0.7%	0.1%	0.4%
TOTAL	100.0%	100.0%	100.0%

Table XXXIV. Percentage age distribution of inpatients admitted to Tumutumu Hospital during period 1944-1953

In the case of the males it will be noted that the maximum number of admissions for any age group was in

the age group 1-4 years, followed closely by the age group 15-24 years. Amongst the female admissions the maximum number was found in the age group 15-24 years with the second highest number in the age group 1-4 years. The total figures show the highest admissions to be from the age group 15-24 years, with the next highest figure from the 1-4 years group.

The average length of stay of patients admitted to Nyeri Hospital is compared with that in Tumutumu Hospital in Table XXXVI.

YEAR	NYERI	TUMUTUMU
1944	6.1	16.0
1945	9.3	19.2
1946	10.7	18.6
1947	7.9	16.7
1948	7.0	14.2
1949	6.6	17.9
1950	7.1	17.3
1951	7.7	16.7
1952	8.9	14.1
1953	7.7	16.7
AVER.	7.9	16.7

Table XXXVI. Comparison of average length of stay in hospital in days of inpatients at Nyeri and Tumutumu.

The average length of stay of an inpatient in Nyeri Hospital is shorter because of the greater pressure on beds there as compared with Tumutumu. Because of the lessened pressure on beds Tumutumu Hospital is able to admit and care for the more chronic cases for whom Nyeri Hospital is unable to find accommodation. This would explain the longer average stay of patients in Tumutumu Hospital.

It is of interest to discover if the inpatient admission rate is related to the number of beds available.

YEAR	BEDS AVAILABLE	INPATIENT ADMISSION RATE
1944	178	5.1%
1945	178	5.5%
1946	198	6.6%
1947	242	7.1%
1948	242	6.9%
1949	258	7.1%
1950	258	6.5%
1951	276	6.3%
1952	276	4.6%
1953	276	4.1%
AVER	238	6.0%

Table XXXVII. Comparison of number of hospital beds available and the inpatient admission rates per cent. of the total population of South Nyeri District for 1944-1953.

This comparison is made in Table XXXVII. The total number of beds given for each year is exclusive of maternity beds. The inpatient admission rate is given as a percentage of the total population and is derived from the figures given in Table XXXII. The correlation coefficient of these two data is - 0.02, and there is therefore no correlation between the number of beds available and the number of inpatient admissions.

The total monthly admissions to the three hospitals of South Nyeri District are given in Table XXXVIII. They are the average monthly figures for the years 1948 to 1951 inclusive.

MONTH	ADMISSIONS	MONTH	ADMISSIONS
JANUARY	1,008	JULY	972
FEBRUARY	951	AUGUST	957
MARCH	1,003	SEPTEMBER	927
APRIL	903	OCTOBER	935
MAY	990	NOVEMBER	913
JUNE	1,075	DECEMBER	895

MONTHLY AVERAGE = 961

Table XXXVIII. Average monthly admissions to hospitals in the South Nyeri District, 1948-1951.

In coming to the end of this section of statistics, it is of value to try and summarise the facts which are set out more fully in the tables.

1. The annual sick rate is inversely proportional to the mean temperature(Table XXI & XXV).
2. Every year one out of every two persons reports sick to a medical institution in South Nyeri District (Table XX).
3. Every year one out of every nine persons is admitted to hospital from amongst those who attend an outpatient institution(Table XX & XXXII). Thus one in nineteen of the whole population is admitted to hospital each year(Table XXXII).
4. Each admission to hospital stays an average of twelve days(Table XXXVI).
5. Every month approximately six thousand patients attend an outpatient institution(Table XXVIII), and nine hundred and sixty-one are admitted to hospital in South Nyeri District(Table XXXVIII).
6. For every patient who attends a dispensary, three attend a hospital outpatient department(Table XXVI & XXVII).
7. For every patient who attends a fee-paying institution, three attend a free one(Table XXX).
8. For any individual complaint an outpatient attends three times as often at a fee-paying institution than he would at a free institution(Table XXXI).

9. For every one patient admitted to a fee-paying hospital, three are admitted to a free institution(Table XXXIII).

SECTION V. ANALYSIS OF MORBIDITY BY DISEASES.

1. Analysis of diseases seen in outpatients.

2. Analysis of diseases seen in inpatients.

3. Extended comments on the diseases seen in inpatients.

ANALYSIS OF DISEASES SEEN IN OUTPATIENTS

At Tumutumu Hospital it has been the custom to destroy the outpatient record books, and so a complete record for the ten years of this study is not available. The records for the years 1951 to 1953 were, however, preserved and from them we may obtain some idea of the diseases normally seen in the outpatient department.

It must be pointed out that the diagnoses in these record books are not those of a fully-trained doctor, but of an African hospital assistant. He can recognise obvious diseases such as kwashiorkor, mumps, lymphoedema and urticaria, and we shall find these entered as specific diseases. In the main, however, the entries are those of symptoms such as headache, cough, fever, abdominal pain etc.. These entries were made when the patient was first seen, and were not corrected on the basis of later investigations such as the result of a blood film examination. It would be impossible to go back and correct the first entry in the rush of a busy outpatient department. The result is that our analysis can do little more than give an impression of the type of sickness seen, but nevertheless it is valuable to have even that where we have so little information at present.

The diagnoses in the table are given in accordance with those of the International Classification of Diseases(1948).

CATEGORY	DISEASE	NUMBER
I. INFECTIVE & PARASITIC DISEASES:		
030	Acute gonorrhoea	322
089	Mumps	111
126	Tapeworm infestation	90
130	Roundworm infestation	138
II. NEOPLASMS:		
229	Benign neoplasms unspecified	6
III. ALLERGIC & NUTRITIONAL DISEASES:		
243	Urticaria	119
286	Kwashiorkor	105
V. MENTAL DISORDERS:		
309	Unspecified psychoses	12
VI. DISEASES OF THE NERVOUS SYSTEM:		
353	Epilepsy	2
379	Inflammatory disease of eye	745
391	Otitis media	306
VII. DISEASES OF CIRCULATORY SYSTEM:		
468	Lymphoedema	28
IX. DISEASES OF THE DIGESTIVE SYSTEM:		
534	Toothache of unspec.cause	596
536	Stomatitis	61

CATEGORY	DISEASE	NUMBER
X. DISEASES OF THE GENITO-URINARY SYSTEM:		
613	Hydrocele	1
XII. DISEASES OF THE SKIN & CELLULAR TISSUES:		
698	Other local infections	871
710	Cracks on feet	112
715	Chronic ulcer of skin	851
XIV. CONGENITAL MALFORMATIONS:		
758	Supernumerary digits	4
XVI. SYMPTOMS, SENILITY & ILL-DEFINED CONDITIONS:		
782	Fainting	8
783	Epistaxis	10
783	Respiratory symptoms	4,405
785	Alimentary symptoms	4,883
785	Jaundice	1
786	Gynaecological symptoms	154
788	Fever	858
788	General aches	1,934
788	Skin rashes	904
790	Debility	112
791	Headache	2,417

CATEGORY	DISEASE	NUMBER
XVII. ACCIDENTS, POISONINGS, & VIOLENCE:		
N908	Open wounds, unspec. location	1,219
N932	Foreign body in nose	2
N949	Burns of unspec. parts	96
N978	Bee-sting	1
N978	Snake bite	1
N996	Rape	18
SUPPLEMENTARY CLASSIFICATIONS:		
Y00	Medical examination	59
Y06	Prenatal care	2,602
Y09	Circumcision	587
	GRAND TOTAL	24,751

Table XXXIX. Analysis of diseases and injuries seen in outpatients who attended Tumutumu Hospital Out-patient Department during the years 1951 to 1953.

The comparative incidence of the diseases and injuries given in the above table are set out in Table XL where the diseases or injuries which form more than one per cent of the total number are included.

SYMPTOM OR DISEASE	PERCENTAGE OF TOTAL SICK
Alimentary symptoms	20.0
Respiratory symptoms	18.0
Antenatal attendances	11.0
Headache	10.0
General aches	8.0
Open wounds	5.0
Skin rashes	4.0
Skin & subcutaneous infections	3.5
Fever	3.5
Chronic ulcer of skin	3.5
Eye infections	3.0
Toothache	2.5
Ritual circumcision	2.5
Acute gonorrhoea	1.3
Otitis media	1.2
TOTAL	97.0

Table XL. Comparative percentage incidence of symptoms, diseases and injuries seen in Tumutumu Hospital outpatients from 1951 to 1953.

We have already explained why many of the diagnoses are only symptomatic in our outpatient records. It is however possible to analyse further the first two categories given in Table XL. The alimentary symptoms are composed as follows:

Abdominal pain	49.5 %
Diarrhoea	30.8 %
Diarrhoea & vomiting	11.0 %
Vomiting	6.3 %
Constipation	2.4 %
Total	100.0 %

The symptom of abdominal pain is a very common one and if its causes could be analysed they would yield a very interesting series of diagnoses, some of which could hardly be classified as alimentary. Unfortunately such an analysis is not possible with our material. The incidence of constipation is low compared with the other symptoms. This may be due to the fact that the African patient does not lack roughage in his diet.

The respiratory symptoms may be further broken down as follows:

Cough	92.1 %
Pain in chest(no cough)	5.2 %
Breathlessness	2.7 %

The respiratory disorders in general are more serious in nature than the alimentary ones. This is shown by the ratio of outpatients to inpatients for both types of disorder. The average number of respiratory disorders treated annually at Tumutumu Hospital for the three years 1951 to 1953 was 1,468 outpatients and 226 inpatients which gives an outpatient to inpatient ratio of six to one, that is, every seventh patient with a respiratory disorder was admitted to hospital. In the case of

alimentary disorders the outpatient to inpatient ratio was 1,627 to ninety, or eighteen to one. Thus only every nineteenth patient with alimentary symptoms was admitted to hospital. However, this is only a rough approximation to the real ratio for it must be remembered that inpatient diagnosis is much more accurate than in the case of outpatients.

In concluding this discussion of diseases seen in Kikuyu outpatients, we would like to refer to certain conditions which mainly occur in outpatient practice and are not therefore referred to in the more detailed discussion of inpatient diseases. The first condition was seen in 112 patients, or about 0.5 per cent. of the total. We refer to it as "cracks on the feet" for it has been given no specific name by other writers. It consists of deep fissures of the rim of the heel or across the sole, which can be extremely painful. Our cases were all adolescents with a three to two preponderance of females, but the condition was first described in West African soldiers by Furnell(1943). A similar condition is described in yaws, but most of our cases had not had yaws for they were born after yaws became a rare disease in Kikuyuland. Jelliffe and Humphreys(1952) also found in their series that the most severe cases gave a negative Kahn reaction and gave no history of yaws. They found that the condition did not respond to arsenotherapy. The condition generally clears up if the patient wears

shoes or sandals, and appears to be due to the multiple minor traumata sustained by the feet from walking over rough and stony ground.

The occurrence of supernumerary digits amongst the African population is much commoner than the four cases noted in this series would suggest. It seems to be one of the commonest congenital lesion found in the African. It is usually dealt with at birth by tying a ligature around the narrow pedicle by which the extra finger is attached to the fifth one.

Rape is not a common charge in Kikuyuland, and the eighteen cases included here all belong to the period of the Emergency when African soldiers of other tribes were deployed throughout the Kikuyu country.

Circumcision is an essential part of the initiation of the Kikuyu boy into the state of manhood. In former days the operation was carried out by a tribal circumciser who used no anaesthetic, and whose technique was neither aseptic or antiseptic. To-day, most of the boys prefer to come to a medical station and have the operation performed under local anaesthetic with proper haemostasis and dressing. The traditional Kikuyu method of ritual circumcision is to remove the prepuce entirely.

ANALYSIS OF DISEASES SEEN IN INPATIENTS

As we turn to consider the morbidity of South Nyeri District as reflected in the inpatient discharges of Tumutumu Hospital, we do well to remind ourselves that "illness treated in hospital is a highly selected fraction of all illness occurring in the community, consisting in the main of conditions requiring specialized medical and nursing care which cannot be provided in the patients' own homes"(Mackay,1951). In Kikuyuland, however, very few homes are suitable places for the nursing of the sick and it is probable therefore that the inpatient figures of a rural hospital in Kikuyu country are less highly selected than those of a town hospital in Britain. Nevertheless they are selected as a result of the operation of various factors, and this must be borne in mind at the outset of our study.

Although we may not use hospital statistics of illness as an accurate index of the total incidence of morbidity in a community, they are of great value in determining what diseases actually occur in that community. Preciseness of diagnosis is more easily attained than with outpatients, and it is for this reason that inpatient statistics are of such value for our study, that we might know what diseases really do occur amongst the Kikuyu people.

It must be noted that our figures refer to inpatient <u>discharges</u>. This means that we must use them with some caution in the assessment of the seasonal incidence of

disease. Thus cases of typhoid fever admitted during one month might not be discharged until the next and an analysis of incidence on a monthly basis would be misleading. For this reason we shall consider seasonal incidence in terms of quarters of the year in order to minimise the error involved in the use of discharges.

One problem which must be faced before we set out our analysis of the morbidity of South Nyeri District as seen in the inpatients of Tumutumu Hospital is that of the patient with a multiple diagnosis. The number of patients of whom this was true was 14.7% of the total number of 27,697 inpatients seen at Tumutumu during the decade under review. This seems a lower percentage than might have been expected in view of the widespread malaria and worm infections. There are several ways in which this problem of the multiple diagnosis might be solved such as recording only the main diagnosis for each patient, or recording more than one but giving one as the primary diagnosis and regarding the others as secondary ones not entitled to as much weight as the primary one. A third method is that used by Logan(1953) in which he recorded all the diagnoses, but gave them only a proportionate weight, thus if two diagnoses were recorded each was given only "half weight" and no attempt was ~~gixen~~ made to differentiate the relative importance of the two conditions. In our table we have recorded all the diagnoses and given them equal weight for we are primarily concerned with the incidence of disease in this section, having already discussed the

number of diseased persons in an earlier section. Thus 27, 697 persons suffered from 31,762 diseases in the ten years of our study and the table given below is an analysis of these diseases.

We have had to ignore the influence of re-admissions on our figures as we have no means of determining what proportion of our cases were in this category.

In our previous study of the sick-rates we excluded maternity cases from our figures. In this section they are included in order to give a complete picture of the work of a rural hospital.

Table XLI gives a complete analysis of the diseases seen in inpatients discharged from Tumutumu Hospital during the decade 1944 to 1953. The diseases are classified according to the three-digit categories of the International Statistical Classification of Diseases, Injuries and Causes of Death(1948).

CATEGORY	DISEASE	NUMBER	DEATHS
I. INFECTIVE & PARASITIC DISEASES:			
Tuberculosis:			
002	Pulmonary tuberculosis	559	243
010	Tuberculous meningitis	5	5
010	Cerebral tuberculoma	3	2
011	Tuberculous peritonitis	57	22
012	Tuberculous bones & joints	85	9
015	Tuberculous lymph glands	97	9
016	Tuberculous epididymitis	2	0
019	Disseminated tuberculosis	1	1
Syphilis & its sequelae:			
020	Congenital syphilis	15	7
021	Early syphilis, primary	8	0
021	Early syphilis, secondary	185	0
027	Late syphilis	3	0
Gonococcal infection etc.:			
030	Acute gonorrhoea	993	0
032	Gonococcal joint infection	2	0
033	Gonococcal eye infection	30	0
035	Late effects of infection	6	0
037	Lymphogranuloma venereum	1	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Infections arising in intestinal tract:		
040	Typhoid fever	117	41
044	Brucellosis	3	0
045	Bacillary dysentery	153	10
046	Amoebiasis	2,762	0
	Other bacterial diseases:		
056	Whooping cough	481	78
058	Plague	1	1
060	Leprosy	200	2
061	Tetanus	137	73
062	Anthrax	113	7
063	Gas gangrene	1	1
	Spirochaetal diseases, except syphilis:		
070	Vincent's infection	2	0
071	Relapsing fever	338	15
073	Yaws	93	0
	Diseases attributable to viruses:		
080	Acute poliomyelitis	5	1
081	Late effects of polio'	8	0
084	Smallpox	3	1
085	Measles	215	23
087	Chickenpox	23	0
088	Herpes zoster	11	0
089	Mumps	52	0

CATEGORY	DISEASE	NUMBER	DEATHS
Diseases attributable to viruses(cont.):			
092	Infectious hepatitis	19	0
095	Trachoma	80	0
Typhus:			
104	Tick-borne typhus	1	0
Malaria:			
112	Falciparum malaria	7,321	18
115	Blackwater fever	5	2
Other infective & parasitic diseases:			
123	Schistosomiasis	9	0
126	Tapeworm	503	0
129	Ankylostomiasis	83	0
130	Ascariasis	1,214	0
130	Oxyuriasis	14	0
130	Trichuriasis	33	0
130	Strongyloidiasis	1	0
130	Hymenolepis nana infection	3	0
131	Dermatophytosis	5	0
134	Moniliasis, oral	17	0
134	Madura foot	2	0
135	Scabies	51	0
136	Pediculosis	2	0
137	Chiggers	17	0
138	Myiasis	1	0
138	Ainhum	1	0

CATEGORY	DISEASE	NUMBER	DEATHS
II. NEOPLASMS:			
Malignant neoplasm of buccal cavity & pharynx:			
143	Of floor of mouth	1	0
144	Of mouth, unspecified	2	1
148	Of pharynx, unspecified	2	1
Malignant neoplasm of digestive organs:			
150	Of oesophagus	2	1
153	Of large intestine	1	1
155	Of liver as primary site	23	8
Malignant neoplasm of respiratory system:			
160	Of nasal cavity	3	0
161	Of larynx	1	1
Malignant neoplasm of breast & genito-urinary organs:			
170	Of breast	7	3
171	Of cervix uteri	10	2
172	Of corpus uteri	1	1
175	Of ovary	1	0
177	Of prostate	3	3
180	Of kidney	1	0
Malignant neoplasm of other & unspec. sites:			
191	Epithelioma of skin	13	1
197	Kaposi's sarcoma	1	0
197	Sarcoma of thigh	1	1

CATEGORY	DISEASE	NUMBER	DEATHS
	Malignant neoplasm of other & unspec. sites(cont.):		
198	Secondary of lymph glands	2	0
	Neoplasms of lymphatic & haemopoietic tissues:		
201	Hodgkin's disease	1	1
202	Other reticuloses	2	1
204	Leukaemia	2	2
	Benign neoplasm:		
210	Buccal cavity	2	0
211	Other parts of digestive tract	1	0
220	Melanoma of skin	12	0
223	Neuroma	1	0
223	von Recklinghausen's disease	2	0
225	Chondroma of auricle	3	0
227	Fibroma	12	0
227	Dermoid cyst	3	0
228	Haemangioma of eye	1	0
229	Other benign tumours	5	0
	Neoplasm of unspecified nature:		
233-5	Of female genital tract	26	0
III.	ALLERGIC, ENDOCRINE, METABOLIC & NUTRITIONAL DISEASES:		
	Allergic disorders:		
241	Asthma	151	0
242	Angioneurotic oedema	9	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Allergic disorders(cont.):		
243	Urticaria	38	0
244	Allergic eczema	7	0
	Diseases of the thyroid gland:		
250	Simple goitre	1	0
251	Nontoxic nodular goitre	6	0
252	Thyrotoxicosis	2	0
	Diabetes mellitus:		
260	Diabetes mellitus	5	2
	Avitaminoses & other metabolic diseases:		
280	Beriberi	1	0
281	Pellagra	2	0
286	Kwashiorkor	331	86
286	Malnutrition, unspecified	18	9
IV.	DISEASES OF THE BLOOD:		
290	Hyperchromic anaemias	2	0
291	Iron deficiency anaemias	7	0
296	Purpura	7	1
V.	MENTAL, PSYCHONEUROTIC & PERSONALITY DISORDERS:		
	Psychoses:		
301	Manic-depressive reaction	2	0
308	Malarial psychoses	21	0
309	Dementia	8	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Psychoneurotic disorders:		
311	Hysteria	5	0
316	Psychoneurosis with digestive symptoms	2	0
	Disorders of character, behaviour, & intelligence:		
322	Alcoholism	3	0
325	Mental deficiency	8	0
VI.	DISEASES OF THE NERVOUS SYSTEM & SENSE ORGANS:		
	Vascular lesions of the C.N.S.:		
330	Subarachnoid haemorrhage	3	2
332	Cerebral embolism & thrombosis	5	4
334	Hemiplegia, unspecified	9	3
	Inflammatory diseases of the C.N.S.:		
340	Purulent meningitis	137	70
	Other diseases of the C.N.S.:		
350	Paralysis agitans	2	1
352	Other cerebral paralyses	6	1
353	Epilepsy	44	0
356	Motor neurone disease	1	1
357	Friederich's ataxia	1	0
357	Spinal cord compression	1	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Diseases of nerves & peripheral ganglia:		
362	Brachial neuritis	1	0
363	Sciatica	2	0
	Inflammatory diseases of the eye:		
370	Conjunctivitis	115	0
371	Blepharitis	3	0
372	Hordeolum	5	0
373	Iritis	16	0
374	Keratitis	7	0
376	Hypopyon	2	0
377	Retrobulbar neuritis	2	0
378	Dacryocystitis	4	0
379	Panophthalmitis	1	0
379	Scleritis	1	0
	Other diseases of the eye:		
381	Corneal ulcer	53	0
383	Pterygium	2	0
384	Strabismus	1	0
385	Cataract	44	0
387	Glaucoma	5	0
388	Chalazion	4	0
388	Entropion	25	0
388	Staphyloma	1	0
388	Vitreous opacities	1	0
389	Blindness	3	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Diseases of the ear & mastoid process:		
390	Otitis externa	2	0
391	Otitis media	79	0
393	Mastoiditis	8	0
397	Deaf mutism	5	0
VII.	DISEASES OF THE CIRCULATORY SYSTEM:		
	Rheumatic fever:		
400	Rheumatic fever without mention of heart involvement.	3	0
402	Chorea	13	0
	Chronic rheumatic heart disease:		
410	Disease of the mitral valve	20	15
411	Disease of the aortic valve	2	1
414	Disease of unspecified valve	1	0
	Other diseases of the heart:		
430	Subacute endocarditis	1	1
432	Acute pericarditis(nonrheum.)	3	1
433	Sinus arrhythmia	1	0
433	Paroxysmal tachycardia	3	0
434	Adherent pericarditis	2	0
434	Cardiac enlargement	1	0
434	Congestive heart failure	22	15

CATEGORY	DISEASE	NUMBER	DEATHS
	Diseases of veins & lymph channels:		
460	Varicose veins, lower limb	3	0
461	Haemorrhoids	3	0
463	Thrombophlebitis, lower limb	8	0
465	Pulmonary embolism	1	1
468	Lymphoedema	60	0
VIII.	DISEASES OF THE RESPIRATORY SYSTEM:		
472	Acute pharyngitis	3	0
473	Acute tonsillitis	130	0
475	Upper respiratory infections	387	0
490	Lobar pneumonia	560	36
491	Bronchopneumonia	1,110	265
511	Peritonsillar abscess	26	0
517	Respiratory obstruction	7	6
518	Empyema	3	0
519	Pleurisy	33	0
IX.	DISEASES OF THE DIGESTIVE SYSTEM:		
	Diseases of the buccal cavity:		
530	Dental caries	25	0
532	Pyorrhoea alveolaris	4	0
535	Bleeding gums	2	0
536	Stomatitis	4	0
536	Bismuth stomatitis	4	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Diseases of oesophagus, stomach & duodenum:		
540	Ulcer of stomach	1	0
541	Ulcer of duodenum	2	1
543	Acute gastritis	7	0
	Appendicitis:		
550	Acute appendicitis	4	0
	Hernia of abdominal cavity:		
560	Inguinal hernia	16	0
560	Ventral hernia	4	0
	Diseases of intestines & peritoneum:		
570	Intestinal obstruction	19	12
571	Acute gastro-enteritis	720	238
573	Constipation	45	0
576	Peritonitis	2	2
578	Rectal prolapse	24	0
	Diseases of the liver & gall-bladder:		
581	Cirrhosis of liver	18	8
584	Cholelithiasis	1	0
	X. DISEASES OF THE GENITO-URINARY SYSTEM:		
	Nephritis:		
590	Acute nephritis	12	6
592	Chronic nephritis	3	0

CATEGORY	DISEASE	NUMBER	DEATHS
	Other diseases of urinary system:		
600	Infections of kidney	5	0
	Diseases of male genital organs:		
610	Hyperplasia of prostate	7	3
	Diseases of female genital organs:		
631	Uterovaginal prolapse	10	0
632	Retroversion of uterus	10	0
634	Dysmenorrhoea	41	0
636	Female sterility	473	0
637	Vaginal atresia, acquired	66	0
637	Vaginal bleeding	58	0
637	Infection of genital tract	78	0
XI.	DELIVERIES & COMPLICATIONS:		
645	Ectopic pregnancy	5	1
650	Abortion	650	0
660	Delivery	6,257	33
678	Vesico-vaginal fistula	24	0
XII.	DISEASES OF THE SKIN & CELLULAR TISSUES:		
690	Boil	1	0
692	Cellulitis & abscess	618	0
698	Pyoderma	4	0
701	Eczema	5	0
703	Exfoliative dermatitis	3	3

CATEGORY	DISEASE	NUMBER	DEATHS
XII.	DISEASES OF THE SKIN(cont.):		
703	Other dermatitis	98	0
705	Erythema multiforme	1	0
708	Pruritus ani	2	0
710	Keloid	2	0
714	Acne vulgaris	1	0
715	Tropical ulcer	551	0
715	Septic sores	6	0
716	Vitiligo	1	0
XIII.	DISEASES OF THE BONES & ORGANS OF MOVEMENT:		
720	Acute pyogenic arthritis	11	0
722	Rheumatoid arthritis	1	1
723	Osteoarthritis	5	0
726	Muscular rheumatism	33	0
726	Acute torticollis	4	0
741	Bursitis	2	0
741	Ganglion	18	0
743	Infective myositis	4	0
748	Clubfoot	11	0
XIV.	CONGENITAL MALFORMATIONS:		
751	Spina bifida & meningocele	2	0
752	Congenital hydrocephalus	12	4
754	Congenital heart disease	6	5
755	Harelip	2	0

CATEGORY	DISEASE	NUMBER	DEATHS
XV.	CERTAIN DISEASES OF EARLY INFANCY:		
766	Pemphigus neonatorum	3	0
767	Umbilical sepsis	1	0
770	Haemolytic disease of newborn	3	3
771	Haemorrhagic disease of newborn	4	4
773	Sclerema neonatorum	2	2
776	Immaturity unqualified	32	32
XVI.	SYMPTOMS, SENILITY & ILL-DEFINED CONDITIONS:		
780	Infantile convulsions	2	0
781	Hemianopia	1	0
784	Hiccough	2	0
784	Haematemesis	10	0
785	Hepatomegaly	2	0
785	Ascites	7	0
785	Abdominal pain	39	0
786	Enuresis	2	0
790	Debility	5	0
794	Senility	14	7
NXVII.	ACCIDENTS, POISONINGS & VIOLENCE:		
N829	Fractures	377	6
N839	Dislocations	40	0
N848	Sprains	42	0
N852	Concussion	18	1
N908	Wounds	712	7

CATEGORY	DISEASE	NUMBER	DEATHS
NXVII. ACCIDENTS, POISONINGS & VIOLENCE(cont):			
N918	Abrasions	14	0
N918	Snake bite	16	0
N929	Contusions	229	0
N949	Burns	124	21
N962	Kerosene poisoning	1	0
N963	Carbon tetrachloride poisoning	3	1
N963	Turpentine poisoning	1	0
N979	Santonin poisoning	6	1
N998	Serum reaction	2	0
N998	Sinus after quinine injection	7	0
SUPPLEMENTARY CLASSIFICATION:			
Y09	Circumcision	119	0
	GRAND TOTAL	31,762	1,522

Table XLI. Analysis of total number of inpatient discharges and deaths for Tumutumu Hospital during the decade 1944 to 1953.

The table is a long one and it is therefore convenient to summarise it under the main sectional headings and this is done in Table XLII below.

SECTION	TYPE OF DISEASE	DISCHARGES	PERCENTAGE OF TOTAL
I.	Infective & parasitic	16,152	50.8
II.	Neoplasms	122	0.4
III.	Allergic, endocrine, metabolic & nutrit'l	571	1.8
IV.	Blood	16	0.1
V.	Mental	49	0.2
VI.	Nervous system	601	1.9
VII.	Circulatory system	147	0.5
VIII.	Respiratory system	2,259	7.1
IX.	Digestive system	902	2.8
X.	Genito-urinary	763	2.3
XI.	Deliveries	6,936	21.7
XII.	Skin & cell. tissues	1,293	4.1
XIII.	Bones & movement	89	0.3
XIV.	Congenital	22	0.1
XV.	Early infancy	45	0.2
XVI.	Symptoms, etc.	84	0.3
NXVII.	Accidents, etc.	1,592	5.0
Supplementary categories		119	0.4
	TOTAL	31,762	100.0

Table XLII. Summary analysis of Tumutumu Hospital inpatient discharges for years 1944 to 1953.

Certain of the figures given in Table XLII are worthy of comment. The high incidence of infective and parasitic diseases amongst the hospital inpatient population is shown by the fact that over half of the inpatients were suffering from diseases which fell into this category. On the other hand there is a low incidence of neoplasms, and diseases of the circulatory and digestive systems. These points need only be noted here for they will be discussed in more detail later in this section when we consider each group of diseases in more detail.

The predominance of infective and parasitic diseases in African patients which we have noted in Table XLII has, however, certain very important consequences in African life which may be mentioned briefly here. The first consequence is seen in the reduced productive capacity of the African people. With their energy sapped by infection and parasites almost from birth and certainly from an early age, it is not to be wondered at that they lack energy for production and manual work. The second is the high death-rate in the earlier decades of life due to infective disease with its resultant influence on the population pyramid which we have already

discussed in the section on population. The third consequences is underlined by Carothers(1953) who found that fifteen per cent. of mental derangement in African first admissions to Kenya's mental hospital was due to infectious disease.

Now that we have analysed the diseases in some detail that we found in our inpatient discharges, it is convenient to enlarge upon the problem of multiple diagnosis. It is orthodox teaching in European medicine that the clinician must try to aim at a single diagnosis in the investigation of his patients. In Africa, as Gelfand(1947a) points out, the student must forget this instruction when he is dealing with an African. In the African multiple aetiology of disease is not uncommon.

In our series there was the following distribution of single and multiple diagnoses:

One diagnosis	23,632
Two diagnoses	3,608
Three diagnoses	430
Four diagnoses	26
Five diagnoses	1
Total	27,697 patients.

Out of the total of 27,697 patients, 4,065 suffered from more than one disease, which gives a percentage of 14.7. In many cases the cause of the multiple diagnosis was a malarial infection or a worm infestation. An attempt to assess the incidence of

these complicating diseases is made in Table XLIV.

I. TWO DIAGNOSIS CATEGORY:

1. Primary disease	+	malaria	1,265
		ascariasis	426
		taeniasis	165
		hookworm	39
		oxyuriasis	1
		trichuriasis	18
2. Ascariasis	+	taeniasis	24
		trichuriasis	4
		hookworm	8
		oxyuriasis	1
3. Taeniasis	+	hookworm	3
		trichuriasis	1
4. Ankylostomiasis	+	trichuriasis	1
5. Primary disease	+	other disease	1,652
		TOTAL	3,608

II. THREE DIAGNOSIS CATEGORY:

1. Primary disease	+ malaria +	ascariasis	97
		taeniasis	26
		trichuriasis	2
2. Primary disease	+ ascariasis +	taeniasis	20
		hookworm	11
		trichuris	6
3. Primary disease	+ hookworm +	oxyuriasis	1
4. Malaria	+ ascariasis +	taeniasis	9
		hookworm	4
	+ taeniasis +	trichuriasis	1
5. Ascariasis	+ taeniasis +	hookworm	2
6. Primary disease	+ 2 other diseases		251
		TOTAL	430

III. FOUR DIAGNOSIS CATEGORY:

1. Primary disease + malaria + ascariasis + taeniasis	8
hookworm	1
hookworm + taeniasis	2
2. Malaria + ascariasis + taeniasis + hookworm	1
3. Primary disease + 3 other diseases	14
TOTAL	26

IV. FIVE DIAGNOSIS CATEGORY:

Amoebiasis + pertussis + bronchopneumonia + malaria + ascariasis	1

Table XLIV. Summary of the multiple diagnosis cases in the Tumutumu series.

The seasonal incidence of disease will be dealt with under the individual diseases, but this seems to be a convenient place to summarise what can be said on this subject. There are certain diseases which appear to be more prevalent during one quarter of the year than during the others. These are as follows:

Increased prevalence during first three months of year:	Bronchopneumonia
	Gastro-enteritis
	Kwashiorkor
Increased prevalence during second three months of year:	Amoebiasis
	Anthrax
	Malaria
	Relapsing fever

Increased prevalence during third three months of year: Bronchial asthma

In order to determine the influence of the wet season on the prevalence of disease a seasonal index was worked out for each disease. This was obtained by dividing the number of cases in the wet period, i.e. the second and fourth quarters of the year, by the number in the dry period, i.e. the first and third quarters. If the index was above unity then the disease was commoner in the wet season, whereas if it was below unity it was commoner in the dry season. For many of the diseases the total number of cases was too small to make the results at all reliable. Those results which appeared to be significant are given in Table XLV. The smaller the number of cases, the less significant is the resultant relationship likely to be.

SEASON	DISEASE	INDEX	NUMBER OF CASES
WET	Bacillary dysentery	1.25	155
	Anthrax	1.16	687
DRY	Measles	0.88	215
	Bronchopneumonia	0.83	1,110
	Kwashiorkor	0.80	331
	Bronchial asthma	0.74	151
	Purulent meningitis	0.56	137

Table XLV. The seasonal prevalence of disease.

It is instructive to try to piece together from our data the diagnostic pattern of hospitals admissions according to sex and age. In the following lists we have included all those diseases which made up more than one per cent of their sex and age group. We have excluded maternity causes in order not to bias the sex incidence of disease.

Leading causes of admission by sex & age group:

I. Ages under 1 year:

MALES	Discharges	FEMALES	Discharges
Malaria	224	Malaria	179
Bronchopneumonia	128	Bronchopneumonia	111
Gastro-enteritis	112	Gastro-enteritis	95
Kwashiorkor	45	Kwashiorkor	49
Whooping cough	26	Whooping cough	30
Amoebiasis	25	Amoebiasis	20
Purulent meningitis	20	Purulent meningitis	15
Upper resp. infection	19	Gonorrhoea	11
Gonorrhoea	19	Measles	9
Ac. conjunctivitis	19	Non-pulmonary tuberculosis	9
Tetanus	12	Ac. conjunctivitis	9
Measles	9	Upper resp. infection	8
Congenital syphilis	8	Burns	8
All discharges	862	All discharges	715
Percentage specified	77.3	Percentage specified	77.4

With the exception of kwashiorkor and burns all the diseases in the above list are infections with malaria,

bronchopneumonia and gastro-enteritis making up the bulk of these. It is worth noting the absence of any significant number of cases of congenital malformations from our figures. This is probably due to the fact that such cases are not usually brought to hospital so readily as in a more developed community, but are hidden in the village.

II. Age 1-4 years:

MALES	Discharges	FEMALES	Discharges
Malaria	903	Malaria	752
Bronchopneumonia	389	Bronchopneumonia	378
Amoebiasis	246	Gastro-enteritis	193
Gastro-enteritis	234	Amoebiasis	167
Whooping cough	166	Whooping cough	158
Ascariasis	158	Measles	145
Kwashiorkor	111	Ascariasis	144
Measles	65	Kwashiorkor	103
Upper resp. infection	55	Upper resp. infection	29
Lobar pneumonia	33	Non-pulmonary tuberculosis	27
Burns	32	Relapsing fever	24
All discharges	3,170	All discharges	2,549
Percentage specified	72.0	Percentage specified	83.0

Infections and kwashiorkor continue to dominate the picture in this age group as in the previous one. Burns occur most commonly in this age group(See Figure 91).

III. Age 5-14 years:

MALES	Discharges	FEMALES	Discharges
Malaria	838	Malaria	757
Amoebiasis	296	Amoebiasis	270
Ascariasis	175	Ascariasis	118
Wounds & injuries	149	Tropical ulcer	105
Tropical ulcer	138	Relapsing fever	73
Fractures	117	Lobar pneumonia	61
Lobar pneumonia	81	Wounds & injuries	60
Taeniasis	68	Pulmon. tuberculosis	56
Relapsing fever	61	Whooping cough	49
Pulmon. tuberculosis	57	Fractures	48
Bronchopneumonia	49	Bronchopneumonia	46
Upper resp. infection	47	Non-pulmonary tuberculosis	35
Whooping cough	46	Upper resp. infection	32
Non-pulmonary tuberculosis	39	Wounds & injuries	30
Tetanus	36	Tonsillitis	22
Anthrax	25	Typhoid fever	22
All discharges	2,738	All discharges	2,243
Percentage specified	81.2	Percentage specified	79.7

Malaria is still in the lead, and amoebiasis has become more common. Worm infestations are becoming more evident, and pulmonary tuberculosis makes its appearance. Wounds and injuries are common in this age group especially amongst the boys. The majority of cases of tropical ulcer was seen in this and the following age group and more often in males.

IV. Age 15-24 years:

MALES	Discharges	FEMALES	Discharges
Malaria	744	Malaria	757
Amoebiasis	516	Amoebiasis	519
Wounds & injuries	213	Gonorrhoea	327
Gonorrhoea	197	Ascariasis	137
Tropical ulcer	150	Pulmon. tuberculosis	110
Ascariasis	118	Tropical ulcer	76
Pulmon. tuberculosis	114	Wounds & injuries	75
Taeniasis	107	Syphilis	74
Lobar pneumonia	73	Relapsing fever	58
Upper resp. infection	56	Lobar pneumonia	52
Fractures	56	Taeniasis	50
Syphilis	29	Tonsillitis	43
All discharges	3,018	All discharges	3,264
Percentage specified	78.7	Percentage specified	76.5

The two main venereal diseases figure prominently in this age group, especially among the females. Tropical ulcer is common especially in the males, and pulmonary tuberculosis is increasing in significance. Relapsing fever and tonsillitis both appear to be commoner amongst females in this age group, whilst wounds and injuries are much commoner amongst males as would be expected. Taeniasis is twice as common in males as it is in females which reflects the old custom of giving the men the meat to eat.

V. Age 25-34 years:

MALES	Discharges	FEMALES	Discharges
Malaria	283	Malaria	778
Wounds & injuries	154	Amoebiasis	234
Amoebiasis	141	Gonorrhoea	212
Gonorrhoea	81	Ascariasis	132
Taeniasis	70	Wounds & injuries	53
Lobar pneumonia	69	Pulmon. tuberculosis	51
Ascariasis	62	Upper resp. infection	27
Pulmon. tuberculosis	52	Lobar pneumonia	42
Fractures	39	Non-pulmonary tuberculosis	24
Asthma	35	Bacillary dysentery	23
Upper resp. infection	30	Taeniasis	21
Tropical ulcer	27	Relapsing fever	20
Syphilis	23	Asthma	17
Non-pulmonary tuberculosis	17	Tropical ulcer	17
Relapsing fever	14	Lymphoedema	10
All discharges	1,328	All discharges	2,122
Percentage specified	82.0	Percentage specified	78.5

The venereal diseases are still prominent, though syphilis is seen mostly in males. Asthma is commonest in the age group 15-34 years and is commoner in males. The lower total discharge figure for males in this age group is worth noting. It is not easy to account for this decrease unless it is related to the fact that this age group is the one from which most males go out of the reserve to seek work.

VI. Age 35-44 years:

MALES	Discharges	FEMALES	Discharges
Malaria	224	Malaria	247
Amoebiasis	98	Amoebiasis	57
Wounds & injuries	90	Ascariasis	35
Taeniasis	47	Gonorrhoea	29
Ascariasis	42	Pulmon. tuberculosis	24
Gonorrhoea	41	Lobar pneumonia	19
Pulmon. tuberculosis	37	Taeniasis	17
Fractures	37	Wounds & injuries	13
Lobar pneumonia	26	Syphilis	9
Upper resp. infections	16	Upper resp. infection	7
Asthma	13	Bacillary dysentery	5
Syphilis	8	Fractures	5
All discharges	836	All discharges	596
Percentage specified	81.2	Percentage specified	78.3

The main conditions seen in this age group are similar to those of the previous one except that tropical ulcer and relapsing fever have now dropped out. It is worth noting how the infections still dominate the picture even in this decade. In European patients there would be a proportion of systemic disorders present by this decade, but this is not so with the African.

VII. Age 45-54 years:

MALES	Discharges	FEMALES	Discharges
Malaria	123	Malaria	103
Amoebiasis	57	Amoebiasis	38
Wounds & injuries	39	Ascariasis	20
Taeniasis	25	Gonorrhoea	15
Gonorrhoea	23	Lobar pneumonia	12
Ascariasis	21	Wounds & injuries	9
Lobar pneumonia	20	Upper resp. infection	7
Fractures	16	Bacillary dysentery	6
Pulmonary tuberculosis	16	Pulmon. tuberculosis	5
Upper resp. infection	11	Hepatic carcinoma	5
Cataract	11	Fractures	5
		Cataract	5
All discharges	473	All discharges	262
Percentage specified	78.3	Percentage specified	87.7

Infections and injuries still predominate, but evidence of ageing is beginning to appear in the form of cataract and hepatic carcinoma.

VIII. Age 55-64 years:

MALES	Discharges	FEMALES	Discharges
Malaria	74	Malaria	39
Amoebiasis	31	Amoebiasis	15
Wounds & injuries	17	Gonorrhoea	9
Ascariasis	16	Ascariasis	9
Taeniasis	14	Bacillary dysentery	5
Lobar pneumonia	13	Taeniasis	4

Pulmon. tuberculosis	11	Lobar pneumonia	4
Cataract	8	Wounds & injuries	3
Fractures	6	Fractures	2
Melanoma of skin	6	Cataract	2
Tetanus	6		
Prostatic hypertrophy	4		
Bacillary dysentery	3		
All discharges	282	All discharges	95
Percentage specified	74.2	Percentage specified	97.0

The number of cases is becoming too small to base any firm conclusions upon, but nevertheless the absence of organic heart and nervous disease is very significant of the difference between African and European medical practice.

IX. Age 65-74 years:

MALES	Discharges	FEMALES	Discharges
Malaria	38	Malaria	25
Taeniasis	13	Amoebiasis	9
Wounds & injuries	12	Lobar pneumonia	6
Lobar pneumonia	11	Ascariasis	5
Amoebiasis	10	Cataract	2
Fractures	4		
All discharges	110	All discharges	59
Percentage specified	80.0	Percentage specified	79.7

X. Age over 74:

MALES	Discharges	FEMALES	Discharges
Malaria	14	Amoebiasis	4
Amoebiasis	9	Senility	4
Senility	8		
Lobar pneumonia	7		
Taeniasis	7		
Ascariasis	5		
Wounds & injuries	2		
Fractures	2		
All discharges	92	All discharges	12
Percentage specified	58.6	Percentage specified	66.6

In this group the predominance of males amongst the inpatient discharges which has characterised the groups over the age of thirty-five becomes even more pronounced.

In concluding this section on the age incidence of disease it may be useful to give some general notes. Malaria and amoebiasis occur in all age groups. Broncho-pneumonia, gastro-enteritis and kwashiorkor predominate in the first two age groups. Whooping cough is commonest in the 1-4 age group. Asaariasis is commonest in the 1-24 age group. Tetanus, anthrax, relapsing fever, wounds and tropical ulcers are most common in the 5-14 age group. Gonorrhoea, syphilis, tuberculosis and taeniasis are all commenest in the 15-24 age group. The age incidence of other diseases will be given in the next section in which the diseases are discussed individually.

EXTENDED COMMENTS ON THE DISEASES SEEN IN INPATIENTS

In the last section we considered the diseases seen in inpatients from a general and statistical point of view. In this section we wish to consider each disease in more detail where its incidence merits such treatment, or each group of diseases where the incidence is not great. We begin with the infective and parasitic diseases.

I. INFECTIVE AND PARASITIC DISEASES:

We have already noted the fact that these diseases make up over fifty per cent. of the total number of the diseases seen in inpatients discharged from Tumutumu Hospital during the ten years of our study. If we break down the total figure for this group we can obtain some idea of the type of infectious disease which prevails in South Nyeri District. This is done in Table XLVI which also includes the deaths due to the different types of disease.

TYPE OF INFECTION	DISCHARGES	DEATHS
	%	%
Protozoal	10,088(62.0)	20(3.5)
Bacterial	3,258(20.0)	511(90.0)
Helminth	1,860(12.0)	0
Spirochaetal	433(2.8)	15(2.8)
Virus	416(2.5)	25(3.7)

TYPE OF INFECTION	DISCHARGES	DEATHS
Parasitic	73(0.5%)	0
Fungus	24(0.2%)	0
Total	16,152	571

Table XLVI. Incidence and mortality of main types of infective disease seen at Tumutumu.

It is at once obvious from the table that the protozoal diseases, that is, malaria and amoebiasis, are the most prevalent type of infective disease. But the most fatal type is the bacterial which, though only responsible for twenty per cent. of the illness, yet causes ninety per cent. of the deaths.

Amongst the bacterial causes of disease in Africans the pneumococcus appears to replace the streptococcus in importance. Scarlet fever and erysipelas are unknown in African patients, and acute glomerulonephritis and rheumatic fever are rare. There appears to be an increased incidence of pneumococcal infections such as pneumonia in the adult and pneumococcal meningitis in the child. No one has yet explained this feature of African pathology.

With these brief generalisations, we now turn to consider the individual infective diseases.

Tuberculosis(001-019):

In his pioneer article on "Primitive tribes and tuberculosis" Cummins(1912) introduced the "virgin soil" theory which he based on a consideration of the incidence of tuberculosis in various countries of the world. He concluded from his studies that the evidence showed that primitive man was practically free from tuberculosis. When, however, he is brought into contact with this disease he shows a greater susceptibility to it than civilised man does. This is because he has never met it before and so has developed no resistance to it, that is to say, he is "virgin soil" for the seed of tuberculosis. This theory has stood the test of time and has been more or less substantiated by the facts discovered since Cummins first propounded it.

We may assume then that tuberculosis did not exist in the dark interior of Africa before outside peoples ventured in. David Livingstone(1857) noted that he had never discovered a single case of the disease in all his travels in Africa. If this is true of East Africa, as we must assume that it is, we are then faced with the problem of the origin of the infection there. There have been several solutions offered to this problem.

We know from the study of Egyptian mummies that tuberculosis existed in Egypt from the predynastic period in the fourth millenium B.C.(Guthrie,1945). We have already seen that the Hamitic invaders of East Africa came from the Nile valley, and it is suggested that they may have brought tuberculosis with them as they came.

This is unlikely. It will be remembered that the Luo tribe is the main remnant of this invasion, and they do not show a very different picture of tuberculous infection from the other tribes. Also they are confined to one tribal area and it would be difficult to explain the widespread distribution of the infection if they were responsible for introducing it to East Africa.

Cummins suggested that the white man was responsible for the introduction of the disease, but this too is unlikely for there never has been a great influx of white men into East Africa. Those who have come have never lived in such close contact with the African as would be needed to produce the widespread infection that there is to-day. The white man did not bring the white scourge to East Africa. Whence came it then ?

Tuberculosis appears to have existed at the coast of East Africa some time before it was introduced to the interior, for a high Mantoux reactor rate was found amongst the coastal tribes by Haynes(1951). This would suggest that the disease came from the coastal region into the interior, and fits in with the suggestion that it was the Indian who introduced tuberculosis to East Africa(Wilcocks,1932). From the earliest days of British interest in Zanzibar, the Indian was the clerk and merchant of the East African coast, and had adequate opportunity to infect his customers, his servants and his slaves. Then a great number of low-caste coolies were brought from India to work on the construction of the railway from Mombasa to Uganda during the years 1896

to 1901. When the railway was finished they refused repatriation and scattered throughout the country, opening small shops in every small township where they sold beads and blankets to the African tribesmen around. They came into close contact with the African, and there was every opportunity for them to infect the latter with respiratory tuberculosis. Of all the theories put forward, this one accords best with the few facts which we posess.

The next problem is the type of infection, whether it is predominantly human or bovine. No extensive work has been done on this problem, but what evidence there is suggests that bovine infection is uncommon. The common variety of cattle in East Africa is the humped Zebu variety(Bos indicus), and it is generally held that this variety is resistant to tuberculous infection. Carmichael(1938) found only 0.8 per cent. of 33,627 bovine carcases to be infected with tuberculosis in Uganda. In Embu District which adjoins the South Nyeri District a small investigation showed that about four per cent. of cattle were infected with tuberculosis, and this figure is given for the Central Province of Kenya(Kenya Medical Department,1947). More recent work in Tanganyika suggests that this figure may in fact be too low, but much more work needs to be done on this subject. The fact is that human infection is much more common than bovine. Carmichael(1938) found only four cases of bovine infection in ~~XXXXX~~ 247 human cases of respiratory tuberculosis. A further important fact to

bear in mind in relation to bovine infection of man is that most Bantu tribes do not drink cow's milk.

The low incidence of bovine infection amongst humans may partly explain why the pulmonary form is much more commonem than the non-pulmonary. In Uganda, Stones(1933) gave the incidence of the pulmonary form as seven times that of the non-pulmonary, and Davies(1947) confirmed this ratio for Mulago Hospital at Kampala. In Kenya, Haynes(1951) found the ratio was about three to one in favour of pulmonary tuberculosis, and our figures show a ratio of just over two to one.

The incidence of tuberculosis in the general population was estimated by Haynes(1951) in his report on "Tuberculosis in Kenya". The incidence over the whole of Kenya was estimated to be 11.1 cases per thousand of population, whilst for the Kikuyu country the incidence was reckoned to be 7.8 cases per thousand. This means that South Nyeri District contains just under 1,500 cases of tuberculosis at any one time. The annual admission rate for Tumutumu Hospital for all forms of the disease is about eighty, and for Nyeri Hospital about 110. If we assume a figure of about forty for the Consolata Hospital, we get an annual admission rate of 230 cases, which is about a sixth of the cases which are estimated to be in the district.

The general impression is that tuberculosis is on the increase in Kenya(Haynes,1951), but Clark(1951b) gave his opinion that it was not increasing in the Fort Hall District which adjoins the South Nyeri District.

Certainly the main focus of infection is in the towns where overcrowded conditions and bad dietetic habits combine to decrease general resistance and increase the possibility of infection.

There is no doubt that tuberculosis is the problem disease of Kenya. This is being increasingly recognised and much is being done to control it with the meagre resources available. Meantime the natural resistance of the African is increasing. He is no longer "virgin soil", but is probably between the true Primitive and the European in his resistance to tuberculosis(Davies,1952).

Pulmonary tuberculosis is still the "captain of the men of death" to use John Bunyan's phrase. It has a case fatality rate of forty-four per cent. and is the leading cause of death in both sexes from five to fifty-four years of age.

The natural history of the disease in East Africa has been pieced together chiefly from post-mortem material such as that studied by Davies(1947). From this material the following picture has emerged as the typical history of tuberculosis in the African:

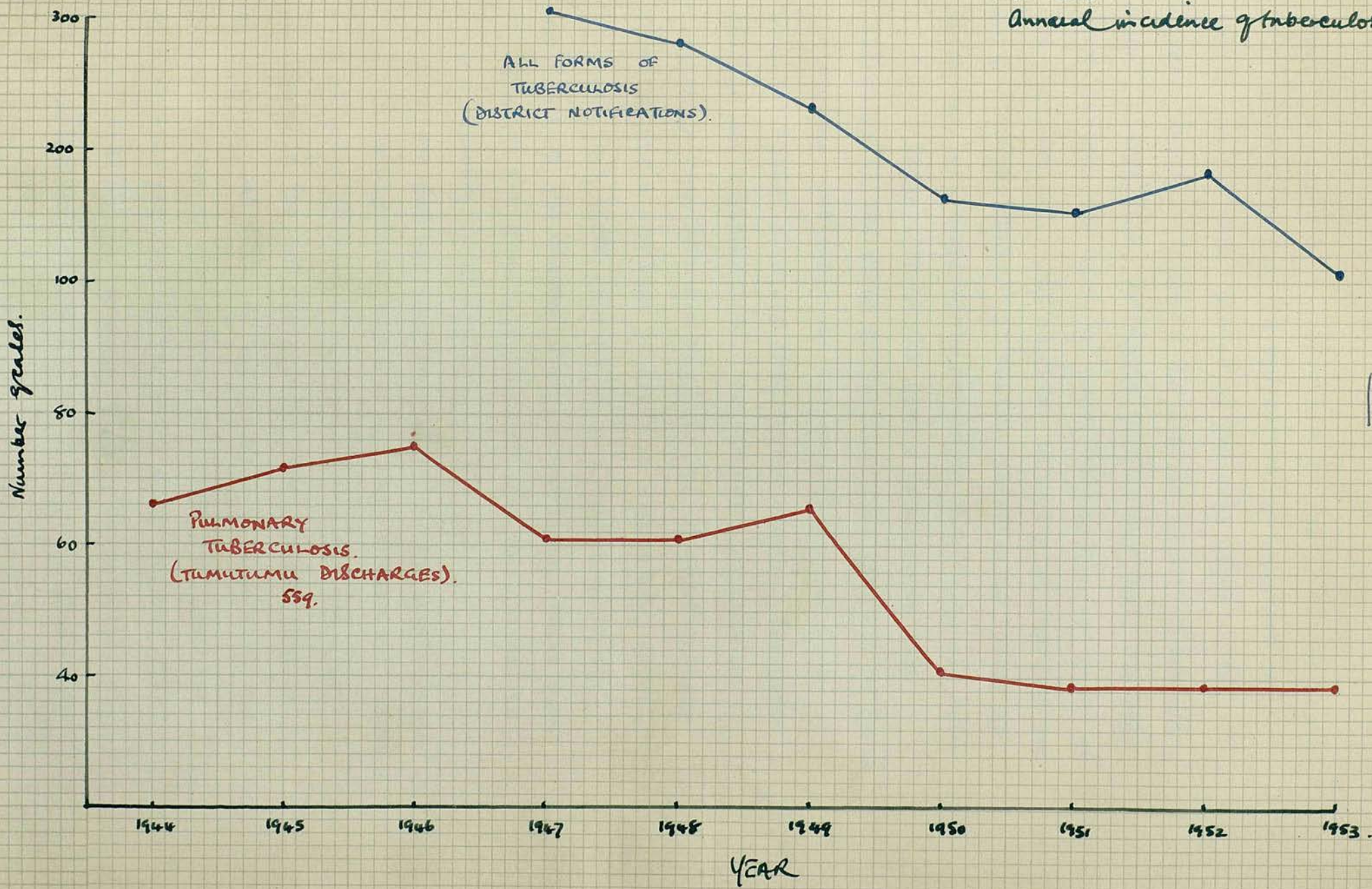
1. The primary infection occurs.
2. A massive primary complex forms & may occur anywhere in the lung.
3. The lesion spreads to other lymph glands and breaks down to give a haematogenous or broncho-pneumonic spread.
4. Miliary spread throughout lungs and body occurs.
5. There is rapid downhill progress to a fatal issue.

6. At post-mortem examination healed lesions are uncommon. There is usually acute cavitation with little or no fibrosis.

On the basis of this picture it is often said that the African type of tuberculosis in adults corresponds to that seen in European infants and children, and consists essentially of a "progressive primary complex." But is should be remembered that this picture is based almost entirely on hospital and autopsy material, and it cannot be accepted as the complete picture until much more field work has been done. Must we assume, for instance, that all primary lesions inevitably become progressive ? Is it not possible that in poorly equipped rural hospitals where there is no x-ray set, the primary tuberculous infection may often be missed and regarded as a non-specific fever ? Haynes(1951) has pointed out that field work does suggest that there are chronic sputum-positive cases in the community. These fibroid cases do not usually attend hospital like the more seriously ill acute cases, and so are not seen. It is they who form an important source of infection to their families and friends.

There are several features of pulmonary tuberculosis in Africans on which investigators have laid stress. The first is the acuteness of the disease, and in the present state of our knowledge, the disease would appear to run a more acute course in the African than it does in the European. Secondly, there may be tubercle bacilli in the sputum without any physical signs demonstrable in the

FIGURE 20:
Annual incidence of tuberculosis.



lungs. Wilcocks(1932) reported a series of 724 patients with tubercle bacilli in the sputum, of whom 227 or thirty-one per cent. showed no physical signs in the lungs. Thirdly, there is the high mortality of the disease. Clark(1951b) estimated that in Fort Hall District about seventy per cent. of cases died within two years of leaving hospital. Our hospital mortality at Tumutumu was forty-four per cent.. It was not possible to follow up those who left hospital to determine their ultimate fate.

In a disease which may have a long course like tuberculosis, the study of its time incidence may be quite misleading. Certainly the seasonal discharges from hospital cannot give any idea of the seasonal incidence and are not analysed here. The annual incidence of discharges from Tumutumu Hospital and of notifications from the whole district is given in Figure 20. It will be noted that there appears to be a reduction in the incidence of the disease over the ten years, which does not support the general impression that the disease is on the increase in Kikuyuland.

The sex and age incidence of pulmonary tuberculosis is given in Figure 21 together with the mortality. There is a slightly increased incidence in males, and a peak incidence in the age group 15-24 years which contains about forty per cent. of the patients. In general the disease is one of adolescence and young adulthood for seventy-nine per cent of the cases occur between the ages of five and thirty-four years. The mortality shows a corresponding distribution being slightly greater in

FIGURE 21: Age and Sex incidence and mortality of pulmonary tuberculosis in Tumutumu Hospital 1944 - 1953 (559 cases).

males and highest for both sexes in the age group 15-24 years.

Non-pulmonary tuberculosis:

Table XLVII shows the comparative incidence of this form of tuberculosis and pulmonary in the small series of cases given in the report on tuberculosis in Kenya by Haynes(1951). With this figure, which is derived from Haynes' experience in several areas of Kenya, our own figures for inpatient discharges from Tumutumu are compared. Both series are small and are derived from hospital experience and may not therefore be typical of the incidence of the two types of the disease in the community. We have already noted the rarity of bovine infection with tuberculosis, however, and this means that most infections will be derived from human sources and thus are most likely to be pulmonary in nature. This would suggest that when more extensive figures are available, the pulmonary form of the disease will be found to be commoner than the non-pulmonary in the community.

TYPE	KENYA	TUMUTUMU
Pulmonary	71.8%	69.0%
Non-pulmonary	28.2%	31.0%
TOTAL NUMBER	419	809

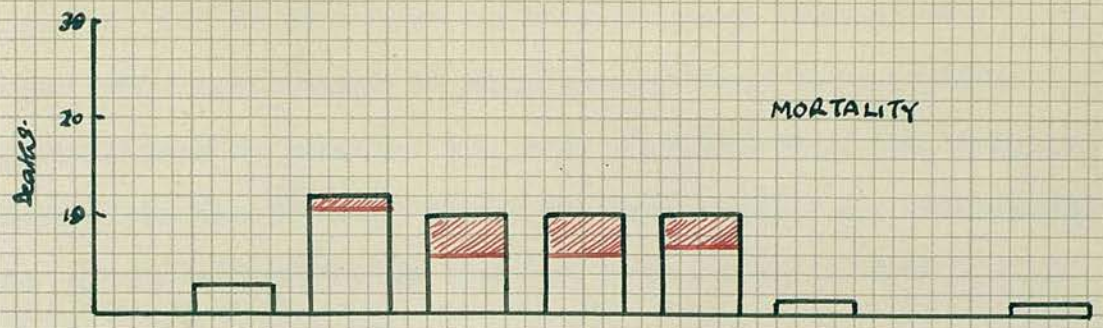
Table XLVII. Comparative incidence of types of tuberculosis.

As in the case of the pulmonary form, the annual and seasonal incidence of non-pulmonary tuberculosis has little significance for we are dealing with a chronic disease. The sex incidence of this type of infection is equal as shown in Figure 22. The peak age incidence is in the age group 5-14 years and so tends to be earlier than in the pulmonary form. The case fatality rate is about nineteen per cent. which compares favourably with that of the pulmonary disease which was forty-four per cent.. The male death rate was almost three times as high as that of the females due principally to the deaths from abdominal tuberculosis.

The different forms of non-pulmonary tuberculosis in our series at Tumutumu were as follows:

FORM	CASES	DEATHS
Glandular	97	9
Bone and joint	85	9
Abdominal	57	21
Meningitis	5	5
Cerebral tuberculoma	3	2
Epididymitis	2	0
Miliary	1	1
TOTAL	250	47

The glandular form affected the cervical glands and chiefly affected the age group 5-14 years, though the age range was from one to twenty-four years. The disease is well-recognised by the Kikuyu who call it the murimo wa ciana or the children's disease, an indication of the common



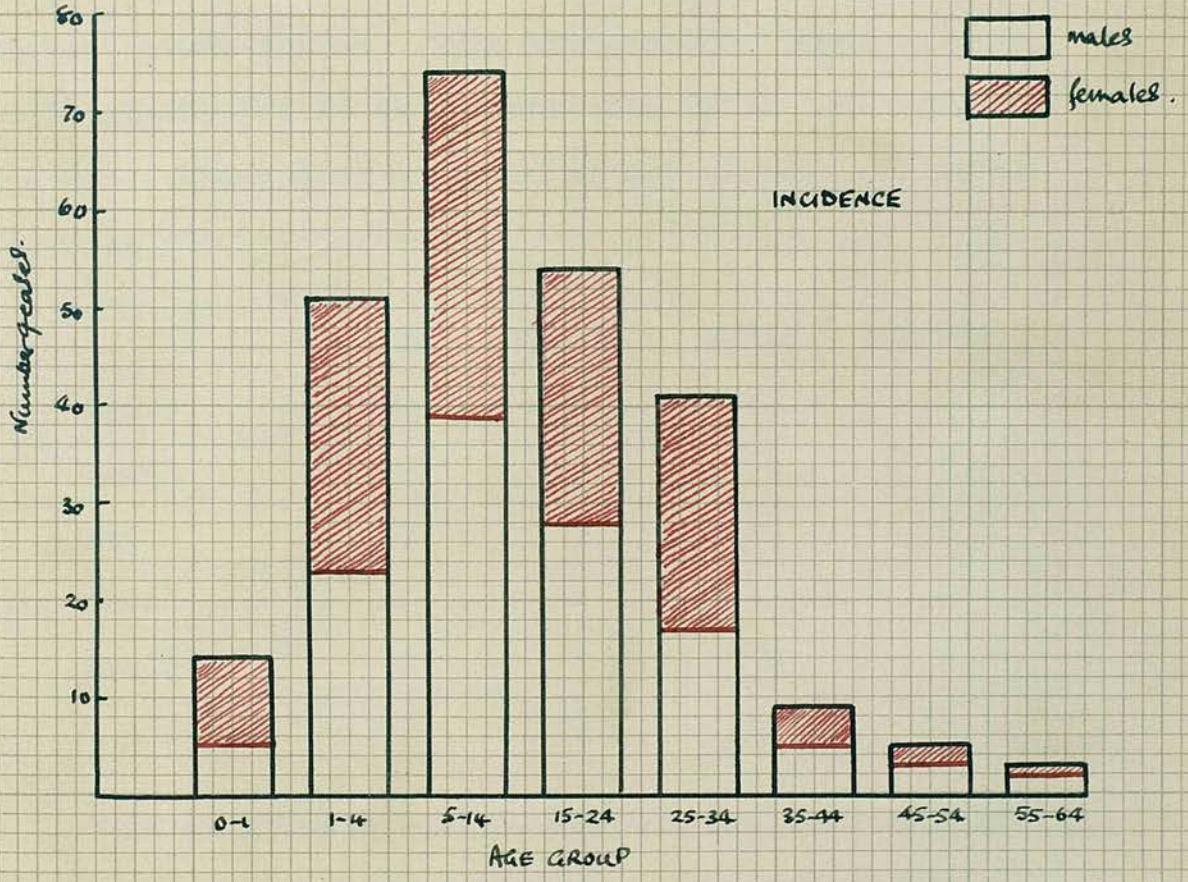


FIGURE 22: Age and sex incidence and mortality of 250 cases of non-pulmonary TUBERCULOSIS.

age incidence of the disease. In some areas this name is only applied to the disease when the glands have caseated and broken down to form sinuses through the skin. The occurrence of nine deaths from this form of tuberculosis is unexpected, and provided that the diagnosis represents the primary cause of death, they are presumably due to the malnutrition and low resistance of the patients concerned.

Bone and joint tuberculosis is said by Willis and Mbuthia(1946) to be commoner amongst the Kikuyu than amongst other tribes. This statement is based on their experience at the Orthopaedic Centre in Nairobi. The bones and joints affected in our series were as follows:

	MALE	FEMALE	TOTAL	DEATHS
Spine	24	26	50	7
Wrist	1	0	1	0
Hip	10	7	17	2
Knee	11	4	15	0
Ankle	0	2	2	0
TOTAL	46	39	85	9

This is a small series, but the preponderance of spinal lesions is very striking. The level of the spinal lesion was rarely specified and so a more detailed analysis is not possible. Two male cases were noted as having a paraplegia. Also the mortality of fourteen per cent. for spinal lesions is high and would appear to mark the infection of the spine as the most

serious type of bone and joint tuberculosis.

The abdominal cases were all diagnosed as those of tuberculous peritonitis. The disease was commoner in the female in the ratio of three to two, but the mortality was higher in the male in the proportion of two to one. The age group chiefly affected was the 5-34 years group. The case fatality rate for this form of the disease was thirty-seven per cent. and was highest in the age group 15-24 years.

The five cases of tuberculous meningitis were all fatal. They were all male children whose ages ranged from six months to three years. Of the three cases of cerebral tuberculoma, two were fatal and the diagnosis was confirmed at autopsy. Cerebral tuberculoma is rare in Europeans, but is not uncommon in Africans. Gelfand(1948) believes it is the most common cerebral tumour in Mashonaland in Southern Rhodesia. He found six cases in a series of two thousand routine autopsies. Our three cases were all in young children aged one to three years.

Genito-urinary tuberculosis appears to be uncommon in the African. Only two cases of tuberculous epididymitis were seen in this series. It is probable, however, that more cases were missed since complete renal tract investigation was not possible. Tuberculous endometritis is not uncommon as a cause for female sterility in the Kikuyu.

It is surprising that no patient was diagnosed as suffering from tuberculous pericarditis during the decade

under review for it is generally believed that this form of the disease is not uncommon in the African. Two cases were seen at Tumutumu in 1954. Also, no cases of tuberculosis of the skin were seen in Africans, which may be due to the abundant natural ultra-violet light there is in the tropics(Charters,1951).

There is no doubt, however, that tuberculosis, and particularly the pulmonary form, is one of the great killing diseases of Africa, and one of the greatest benefits which Western medicine could confer on Africa is the control of this dread disease by all possible methods.

Syphilis(020-027):

Syphilis was probably introduced to West Africa about the same time as it reached Europe, in the early sixteenth century(McElligott,1949). Some authors believe that the Portuguese were responsible for bringing the infection from West Africa to the East African coast later in the same century, but it did not spread into the interior until much more recently. Other authorities believe the infection was only introduced by the Arabs in the middle of the nineteenth century. Whoever was responsible for its introduction may not be discoverable now, but the fact is that the infection only reached the interior in the early years of the twentieth century. In the case of the Kikuyu we can date its first appearance almost to the year. They have a custom of naming the group of youths circumcised in any year by the outstanding event of that year. In the year 1901 they chose

the name gatego which is their word for syphilis as the name of the circumcision group for that year. Thus we may conclude that it was in that year that the disease first forced itself into the limelight. The infection became very widespread after the first world war with the increased facilities for communication and movement that the war brought. Lewis(1942) writes of the modern situation that to-day there is "hardly a place on the continent(of Africa) where the disease is unknown."

The problem of the incidence of syphilis is complicated by the presence of yaws in Kikuyuland, as in many other places in Africa. To-day, however, yaws is a rare disease amongst the Kikuyu as a result of the mass bismuth injection campaigns against it in the nineteen-twenties. The authorities have never finally agreed on the true relationship of these two diseases, but it is of interest to note that the Kikuyu distinguished them by name, and were able to appreciate that a new disease had come into their midst when syphilis came at a time when yaws was rampant in the land. They called syphilis gatego, which is derived from the verb gutega which means - to set a trap for. This name probably is connected with the way in which syphilis is contracted, though no doubt the Kikuyu regarded the real cause of the appearance of the disease as witchcraft indulged in by his(or her) consort. Yaws, on the other hand, was called mutukia, a name of unknown derivation.

De Mello(1948) gave some figures which may help us to get some idea of the incidence of the disease in the

general population. He examined a sample of Africans in Nairobi in the year 1940 and found that thirty-six per cent. of them had signs of syphilis. In the same year he examined a group of Kikuyu in the Kiambu District and only six per cent. of them showed signs of syphilis. Four years later he examined another sample of the Kikuyu population of Kiambu and this time he found that about twenty per cent. were infected. These figures must be accepted with some caution, but may be taken as suggesting that the infection rate is higher in the town than in the country, and that it is increasing in the country.

Our cases of syphilis were treated as outpatients as well as inpatients and so our figures for inpatients do not give an accurate picture of the incidence of the disease, and show a preponderance of those cases who were infectious and who were therefore admitted in order to protect the community. The number of discharges showed no great variation from year to year, or even from month to month. The sex and age incidence of our inpatients is given in Figure 23. More females were seen than males in the infectious stage. The peak incidence for any age was in the age group 15-24 years.

Classified according to the stage of the disease, our cases are as follows:

Congenital syphilis	15 cases(7 deaths)	
Primary stage	8	
Secondary stage	185	
Tertiary	3	TOTAL = 211 cases.

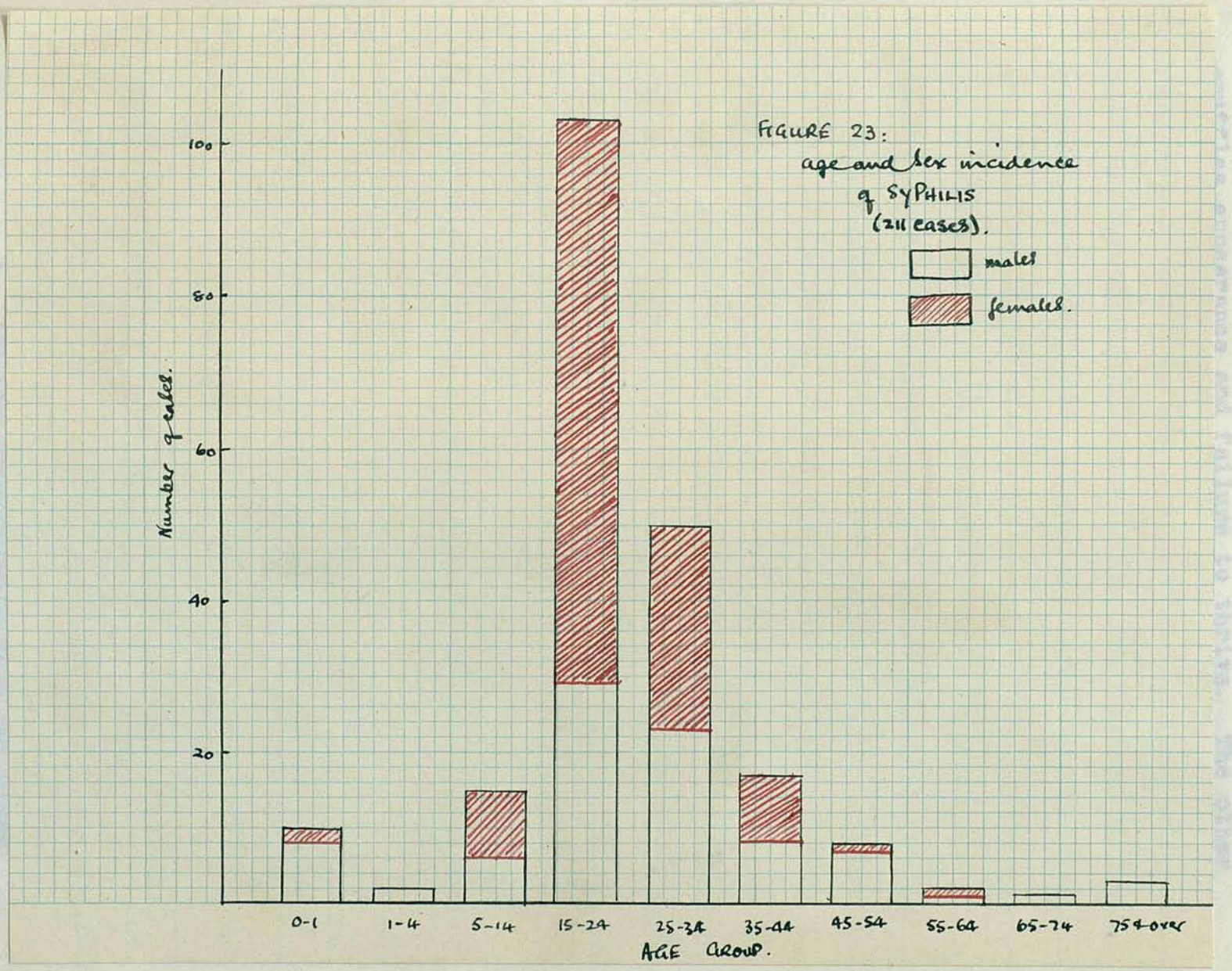


FIGURE 23:
age and sex incidence of SYPHILIS (211 cases).
males
females.
Number of cases.
100
80
60
40
20
0-1
1-4
5-14
15-24
25-34
35-44
45-54
55-64
65-74
75+over
AGE GROUP.

The congenital cases included ten infants who were born to syphilitic mothers and showed the typical snuffles appearance and failure to thrive. The other five were in the age group 1-14 years, but showed few of the classical stigmata of congenital syphilis. Interstitial keratitis occurs occasionally, but I have never seen the Hutchinsonian incisors and the saddle-nose. It is suggested that the reason for this is the early death that most congenital syphilitics die in Africa, but the occasional one lives through the period of the second dentition and might be expected to show changes in the teeth.

The patients with primary lesions were all males who showed the typical ulcer on the penis. The primary lesion is rarely seen in the female as it is usually in the vagina. Few patients come for treatment in the primary stage as they regard a small ulcer as not worth seeking medical advice for, and this explains why there are only eight cases in this series.

The secondary cases all came complaining of mucous patches in the mouth or genito-anal area, or of a general skin rash.

The tertiary lesions were more debatable since it was difficult to differentiate them from yaws. Three of the case records included the diagnosis of tertiary syphilis and there seemed to be no reason for disputing that diagnosis although full details were not given.

Not a single case of cardiovascular syphilis was diagnosed. This is said to be very common in American Negroes(Lewis,1942), but is uncommon in Africa. In Uganda

Davies(1947b) found it not uncommonly in two series of autopsy material he studied at Kampala. It accounted for seven per cent. and ten per cent. respectively in the series.

Neurosyphilis was diagnosed in the Tumutumu series in no patient, but it is believed to be on the increase in Kenya. Carothers(1948) found that 4.6 per cent. of all first admissions to the Kenya Mental Hospital in Nairobi were due to syphilis. In Uganda, Muwazi and Trowell(1944) stated that thirty per cent. of all certifiable insanity there was due to syphilis. Carothers(1953) states that early meningovascular syphilis, syphilitic cerebral thrombosis and myelitis are common, as well as gummata which may cause the symptoms of a space-occupying lesion in the brain or spinal cord, whilst tabes dorsalis is mysteriously rare. General paralysis of the insane is common in Uganda, but less frequent in Kenya and Tanganyika. It used to be thought that endemic malaria protected the African from the neural complications of syphilis, but this theory is no longer held. It is now realised that the reason for the small incidence of neurosyphilis is the fact that syphilisation of the African is in an early stage. It was Kattner(1927) who first used the incidence of neurosyphilis as the index of the degree of syphilisation of a community. He defined three stages as follows:

Early stage: neurosyphilis uncommon, but increasing.

Middle stage: neurosyphilis maximum and beginning to decrease.

Last stage: neurosyphilis at minimum incidence.

According to Kattner, the African was in the early stage, the white man in the middle stage, and the American Indian in the last stage.

Uganda would appear to be further on in the syphilisation process than Kenya as neurosyphilis and cardiovascular syphilis are both commoner there. The Kikuyu in common with the other tribes of Kenya are in the early stage of the process and the incidence of neurosyphilis can be expected to increase in the future.

We may conclude this brief review with the words of McElligott(1949) written after a tour of Tropical Africa to study the problem of venereal disease there: "Whilst much has been said and a little written to the contrary, it seems that both gonorrhoea and syphilis run much the same course in tropical Africa as they do in more temperate climates, and the apparent frequency of complications such as urethral stricture and the more florid secondary and tertiary skin lesions of syphilis, is due to the fact that, generally speaking, the African will only complain of a condition that is visibly obvious or painfully inconvenient."

Gonorrhoea(030-035):

Gonorrhoea may be presumed to have originated in East Africa in a manner similar to that by which syphilis came. First brought to the coast by some immigrant people, it was then taken into the interior by the exploring and trading caravans, and now has been spread widely amongst the tribes of the interior. McElligott(1949), however,

thought that the disease "seems to have existed from time immemorial" in the interior, but gives no evidence for his theory. We have no convenient dating for the early appearance of the disease in Kikuyuland as we had for syphilis, but we know that the disease was widespread in the year 1911(Kenya Medical Department,1911).

The Kikuyu name for the disease is muthiori, which is derived from the verb guthiora, to twist or stir up. The name refers to the urethral pain experienced during micturition in cases of acute gonorrhoea. The Swahili also name the disease from the symptom of pain which it produces. They call it kisonono from kusonoa which means to cause hurt or pain. They also distinguished certain stages of the disease: kisonono cha mkojo when the urine caused pain; kisonono cha usaha when the pain was associated with a purulent discharge; and finally, kisonono cha damu when the pain was associated with the passage of blood. The last stage would need to be differentiated from vesical schistosomiasis.

As in the case of syphilis, our figures do not give an accurate account of the incidence of the disease for many cases were treated as outpatients. Figure 24 does however suggest that the incidence of the disease is rising. It may equally well mean that more patients come for treatment in these days when treatment is more effective. There is no signfficant seasonal variation in the disease. Twice the number of females were treated than males, but it is difficult to conclude therefore that the incidence is twice as high amongst females. Frequently the males refuse to come for treatment, and a urethral discharge

FIGURE 24: The annual incidence of Gonorrhoea at Tumutumu.

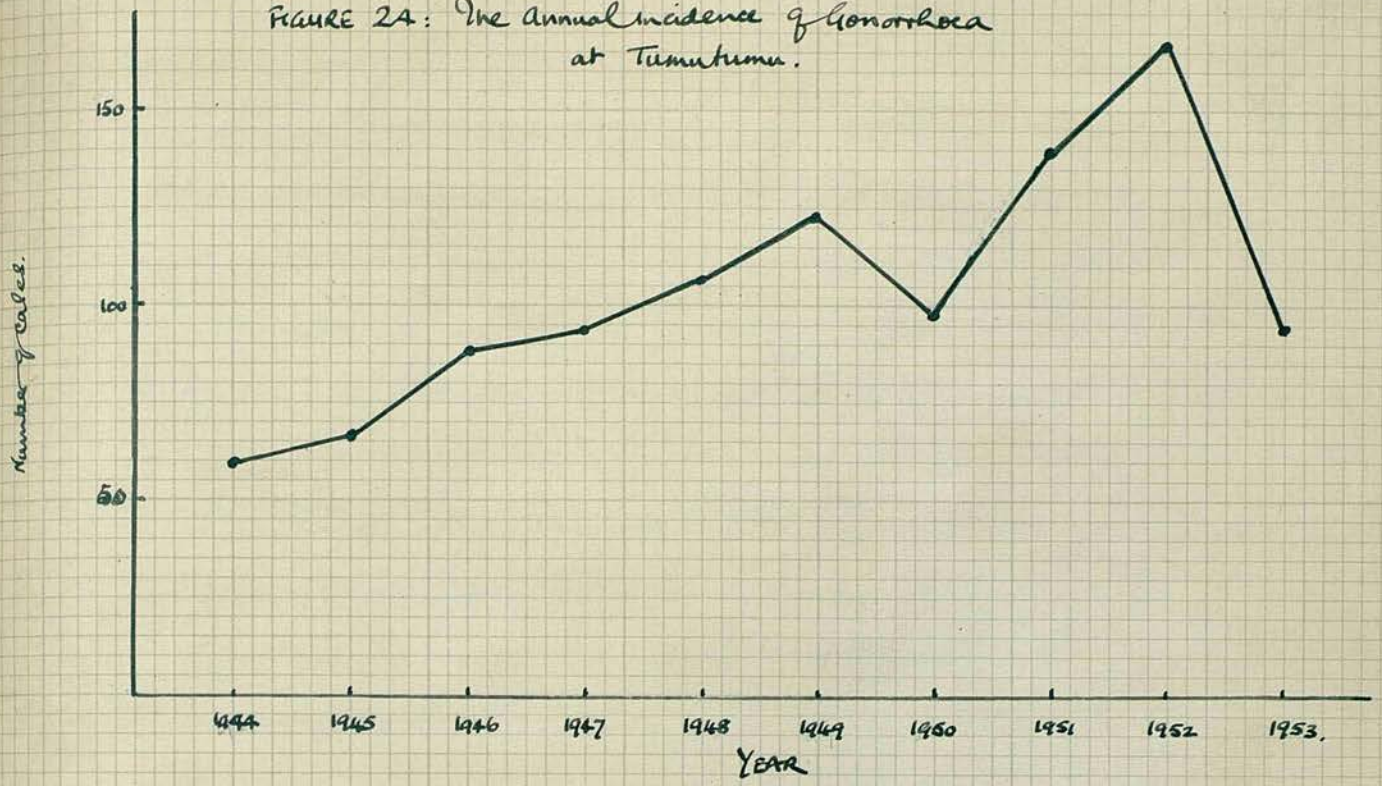
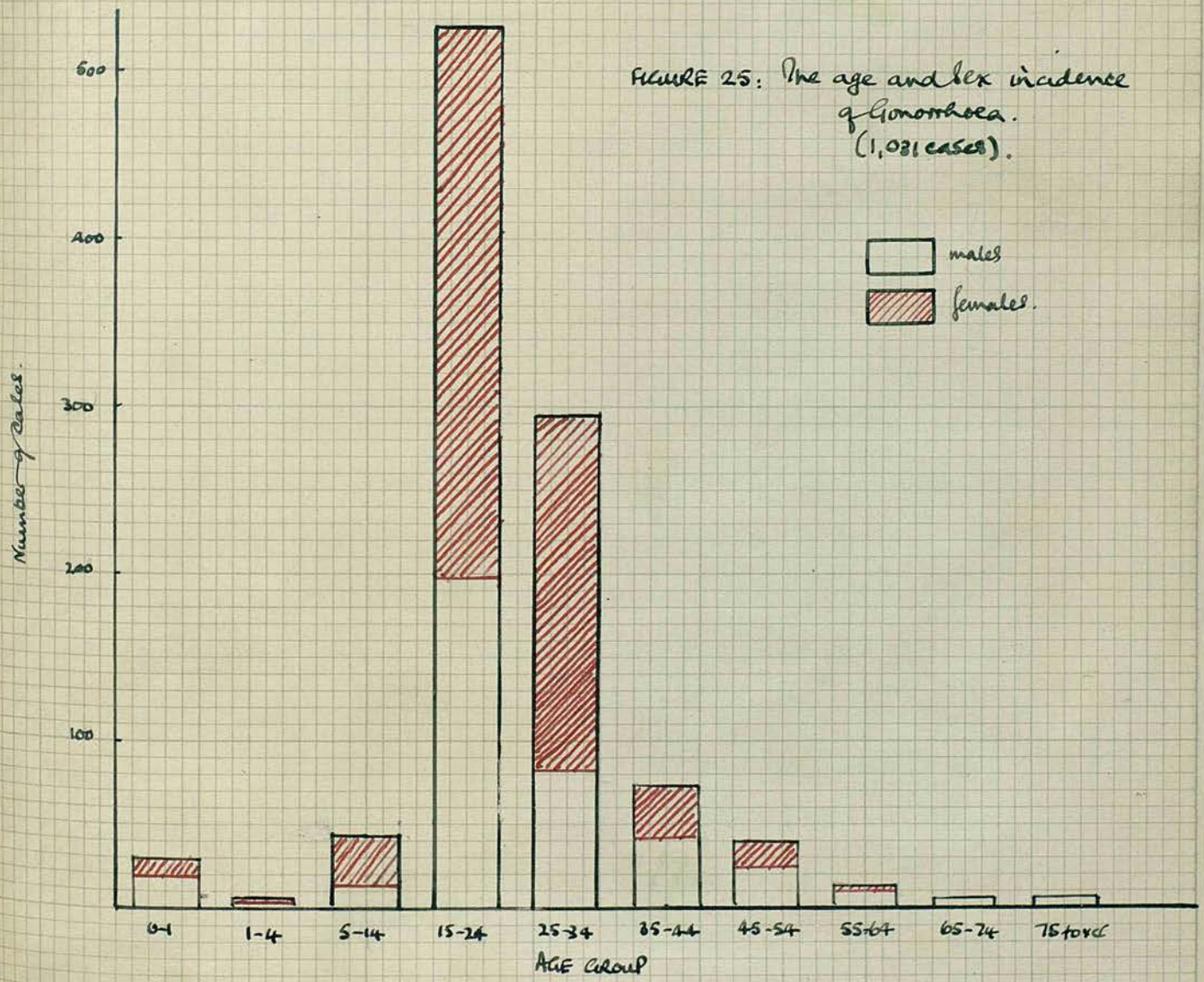


FIGURE 25: The age and sex incidence of Gonorrhoea. (1,081 cases).



about which no advice has been sought is not uncommonly discovered on routine medical examination.

The age incidence shown in Figure 25 shows a peak in the age group 15-24 years. One feature not shown by the figures is the number of young girls and boys who contract the disease. The total of forty-one cases in the age group 5-14 years is high enough when it is realised that these are all venereally-acquired infections. Many of these infections are only discovered when the children are medically examined for admission to boarding school. The total does not, however, give a true picture of the incidence of the infection of children amongst a people whose active interest in sex begins at an early age.

The complications of gonorrhoea in this series are surprisingly few in number. They are as follows:

Gonococcal ophthalmia	30 cases
Urethral stricture	6 cases
Gonococcal arthritis	2 cases

It is probable that there were other cases in which the evidence of gonococcal aetiology was not revealed. The incidence of urethral stricture is not high as it appears to be in Uganda where McElligott(1949) could advance no reason for its apparent high incidence.

The main malign influence of the disease is on female fertility. No estimate of the extent of this problem amongst the Kikuyu has been made, but there are two reviews of the problem amongst their neighbours, the

Masai. Sequeira(1932) estimated that thirty per cent. of the eligible women of the Masai tribe were sterile as the result of gonococcal salpingitis. More recently, Mackay(1950) gave 15.3 per cent. as the figure and this is probably more accurate. It is possible that the disease has a similar effect in producing sterility amongst Kikuyu women.

Lymphogranuloma venereum(037):

One case of this infection was diagnosed in the Tumutumu series. In military experience during the second world war, this disease was almost entirely confined to the coastal region of East Africa (Bettley,1945), but did occasionally occur inland. The Tumutumu case was in a male aged thirty years. There was no information in the case notes about his movements and so it was not possible to discover where he might have been infected.

Typhoid fever(040):

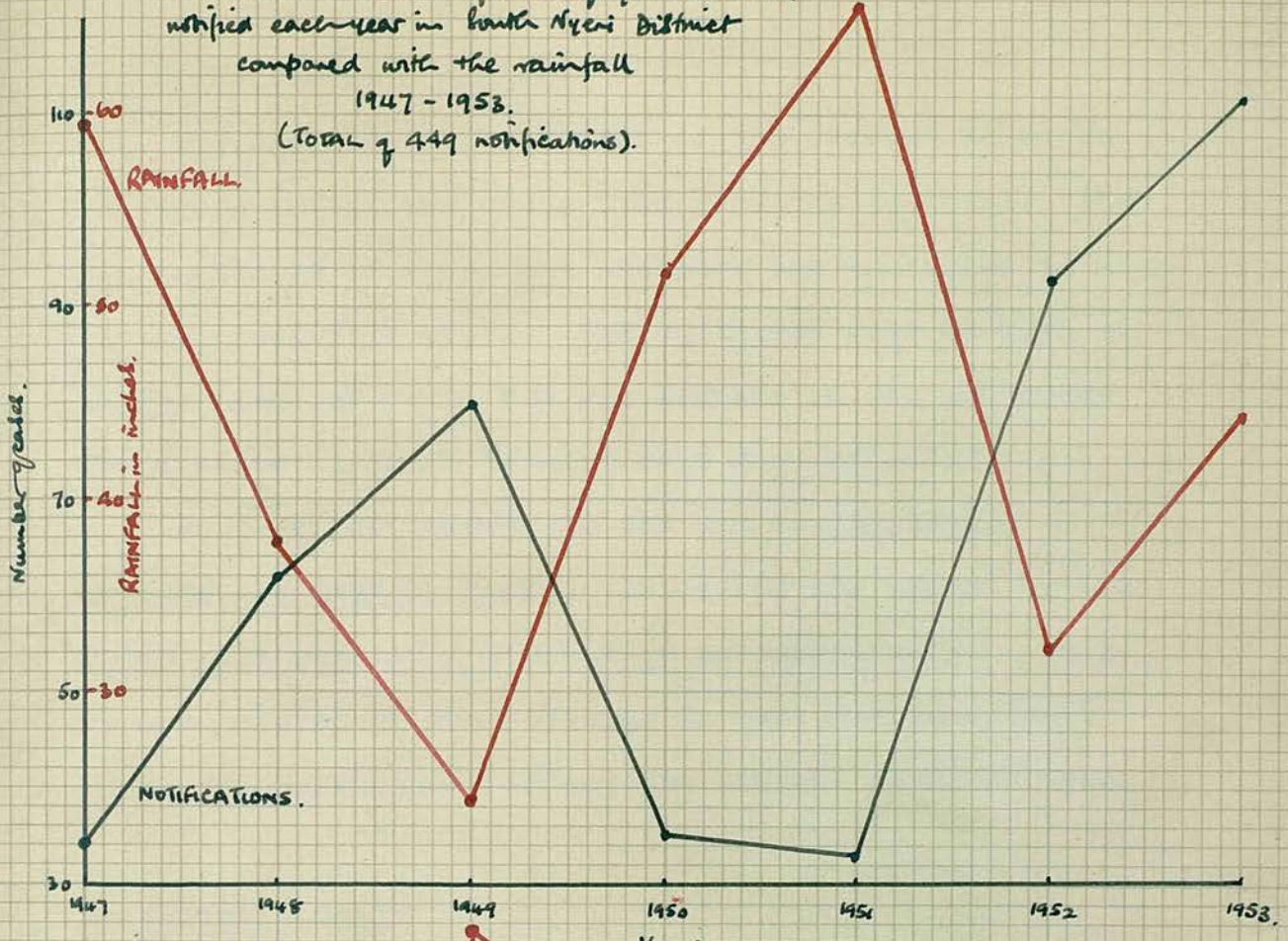
"It was long thought that typhoid fever was a comparatively rare disease in the tropics and that their inhabitants enjoyed a definite degree of relative immunity. This can no longer be considered to be correct; the error was due to inaccurate diagnostic confusion of the enteric fevers with other diseases, and particularly with malaria."(Gay,1935).

Typhoid fever is endemic in Kenya and probably has been so for a long time. In 1937 Dowdeswell working in

Nairobi tested four hundred blood sera which had been sent in from all over Kenya for the Kahn reaction, for typhoid agglutinins. Forty-six per cent. were positive. These people had not been given T.A.B. inoculation and Dowdeswell concluded that his results suggested "the presence amongst the population of a considerable amount of typhoid infection."

The first cases to be reported from the South Nyeri District were in three Europeans in the year 1913. To-day we know that typhoid fever is endemic in the district and every year sees an outbreak of fresh infections. Figure 26 gives the number of notifications for each year for which the total figure is available, and relates them to the average rainfall for the year. It will be seen that, with the exception of the year 1953, there is a clear inverse relationship between these two values. Typhoid fever is prevalent when the year is drier than normal. This may be due to the fact that when the rains are poor the people are restricted to fewer water sources and therefore many more people use the same source and increase the possibility of the spread of water-borne infections. The anomalous rise in 1953 in the number of notifications indicates the operation of a new factor. It was in this year that the process of concentrating the people into villages was begun and this increased the possibility of the spread of infection too. The incidence of the disease is greatest in the second half of the year, and it is not so clearly related to the seasonal rainfall as it

FIGURE 26: Number of cases of TYPHOID FEVER notified each year in South Nyeri District compared with the rainfall 1947 - 1953. (TOTAL of 449 notifications).



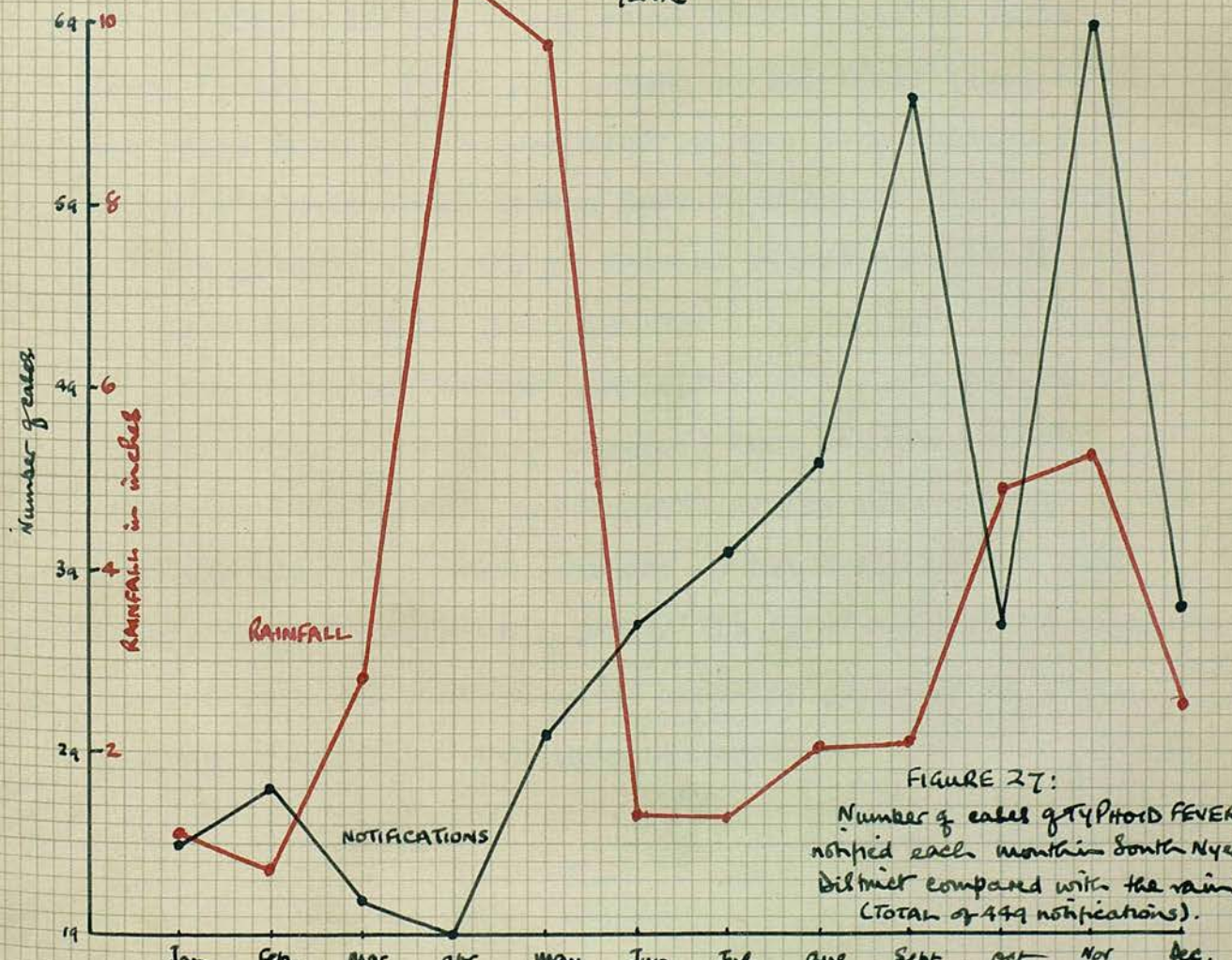


FIGURE 27:
Number of cases of TYPHOID FEVER notified each month in South Nyeri District compared with the rainfall. (TOTAL of 449 notifications).

is to the annual(see Figure 27).

The age and sex incidence of the disease is given in Figure 28 for the cases from Tumutumu Hospital. The sex incidence is equal and the peak age incidence is seen in the group 5-14 years. The mortality rate is high at thirty-five per cent. and was highest in the age group 25-34 years in which females were most affected.

Most of the infections are due to Eberthella typhosa(Bacillus typhosus), but a few are caused by the Salmonella paratyphi B(Bacillus paratyphosus B). This is the reverse of what obtains in most European lands where the paratyphoid infections are the commoner type.

Brucellosis(044):

There is little to say about brucellosis in South Nyeri District. It is not common as the three cases in ten years show. It is believed to have been brought into Kenya by Somali sheep driven down from Somalia to be sold and slaughtered there(Kenya Medical Department,1911). It first appeared in Nyeri in 1924.

The organism responsible is the melitensis strain and infection is probably acquired from drinking cow's milk since the Kikuyu, and especially the Meru amongst whom the disease is very common, do not drink goat's milk (Kenya Medical Department,1950). It is also possible that the infection is contracted by handling goats or by their fouling of the huts with infected urine.

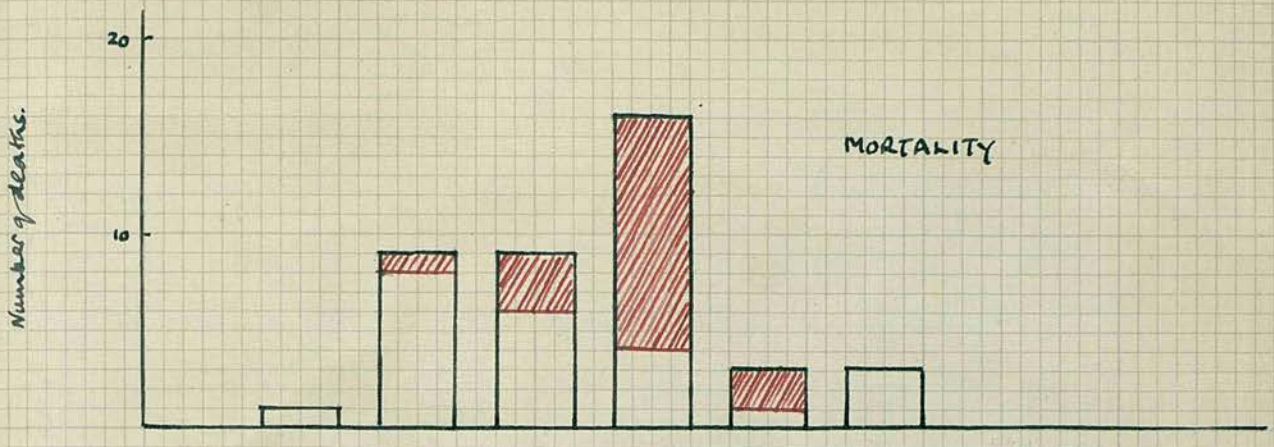
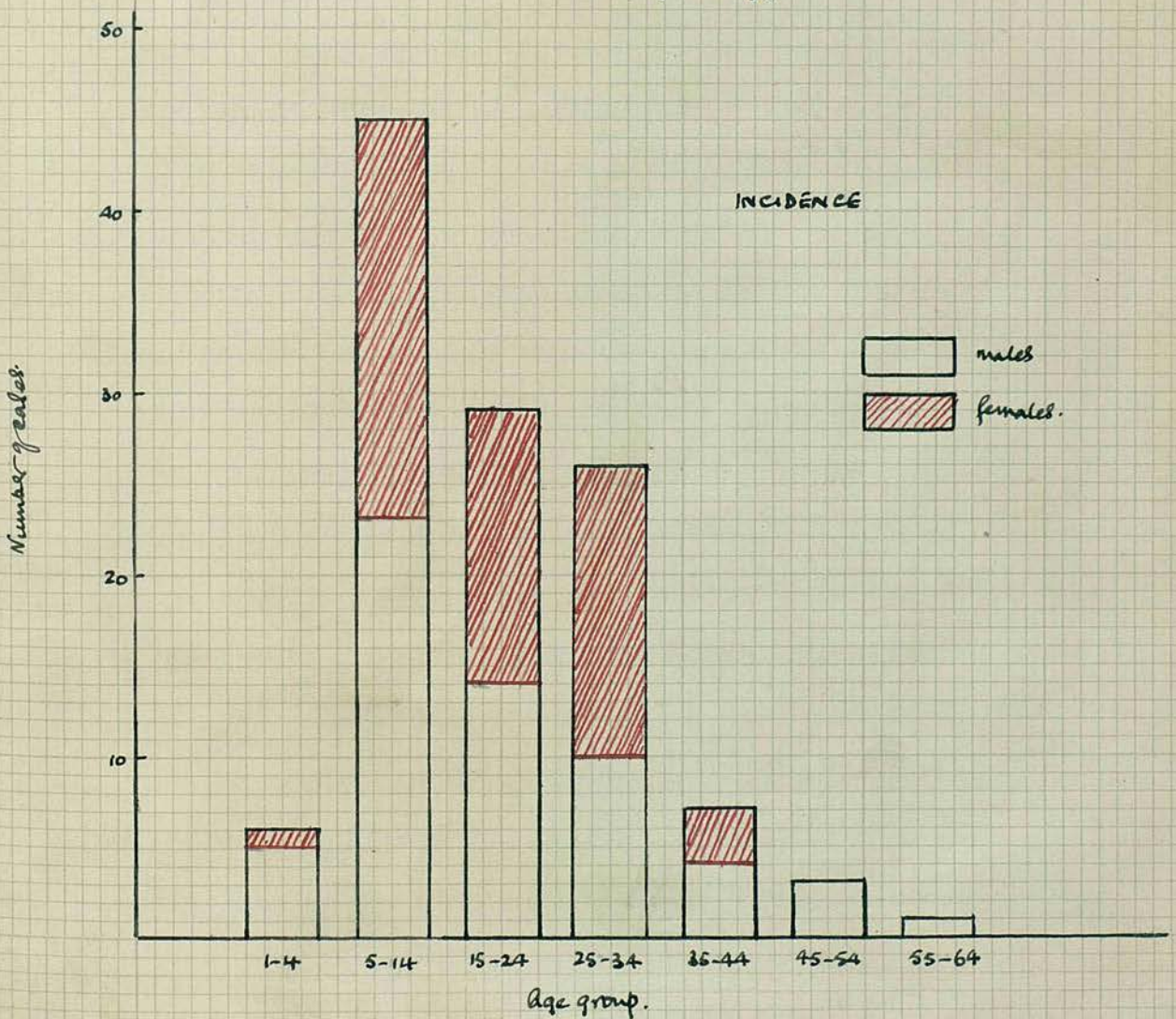


FIGURE 28:
Age and sex incidence and Mortality of cases of TYPHOID FEVER seen in Tumutumu Hospital 1944-53.
(117 cases).



Bacillary dysentery(045):

"Bacillary dysentery" is a clinical diagnosis since no bacteriological examination of the stools of these patients was carried out. In other centres where such examinations are done, the infection is usually found to be due to one of the Flexner group of organisms. The Kikuyu mode of life lends itself very readily to the contraction of intestinal infections, and so it is surprising to find how few patients were admitted to hospital with bacillary dysentery in the decade under review.

The annual incidence of the disease appears to be decreasing to judge from Figure 29, at least so far as the severe type which requires hospital treatment is concerned. If this is so, then such a decrease can be attributed to the years of patient hygiene propaganda and teaching which have been given to the Kikuyu people.

Sir Leonard Rogers(1930 & 1933) in his studies on climate and disease found that bacillary dysentery was commoner in the wet season. He attributed this to the fact that the wet season was the time of greatest fly dissemination. Our figures are too small to be of any significance in this respect for we had only eighty-five cases in the wet season as opposed to sixty-eight in the dry. We would need to have a much larger series than our present one if we were to be able to establish any significant preponderance of the numbers of cases of bacillary dysentery seen in the wet season over those seen

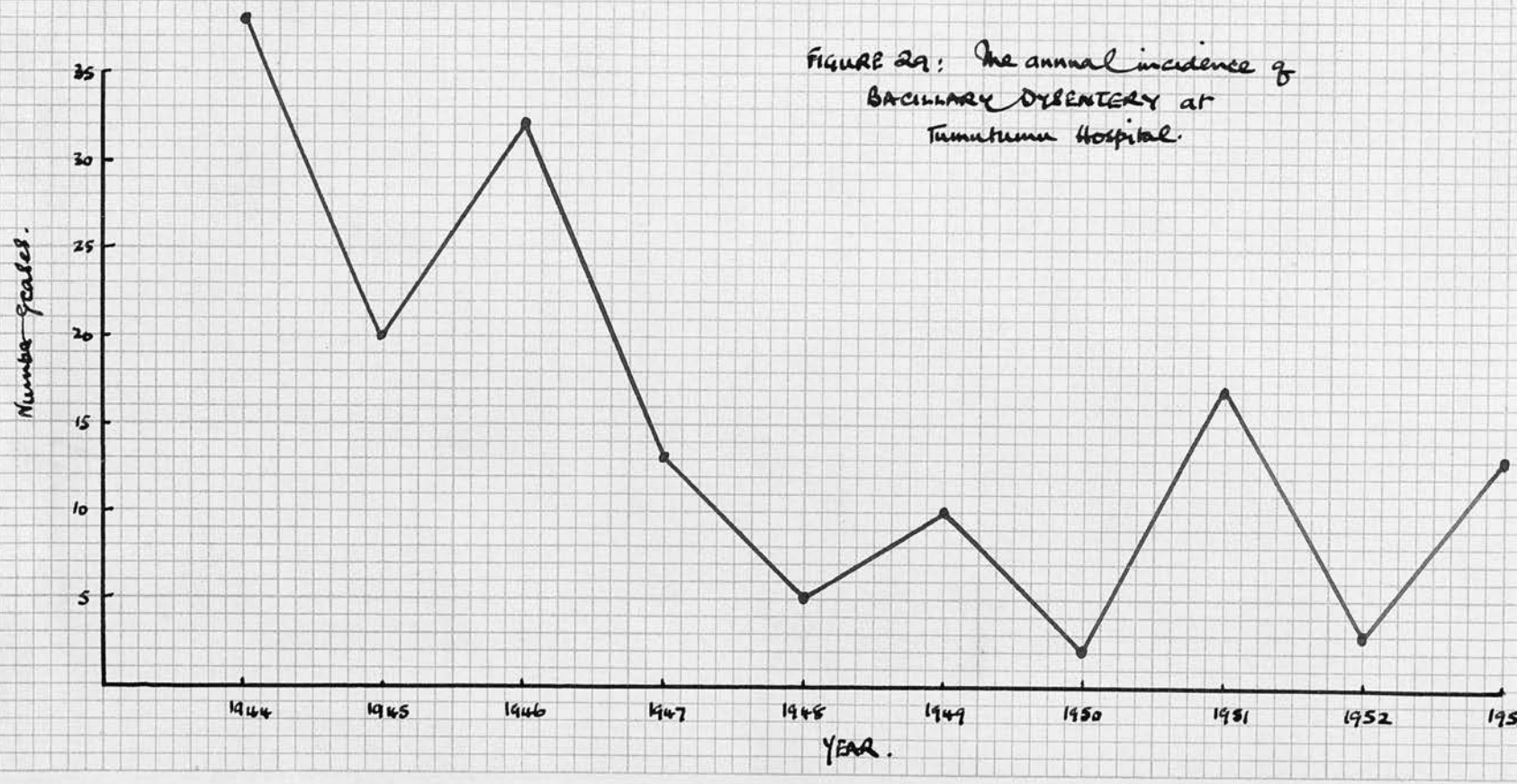


FIGURE 29: The annual incidence of BACILLARY DYSENTERY at Tumutumu Hospital.

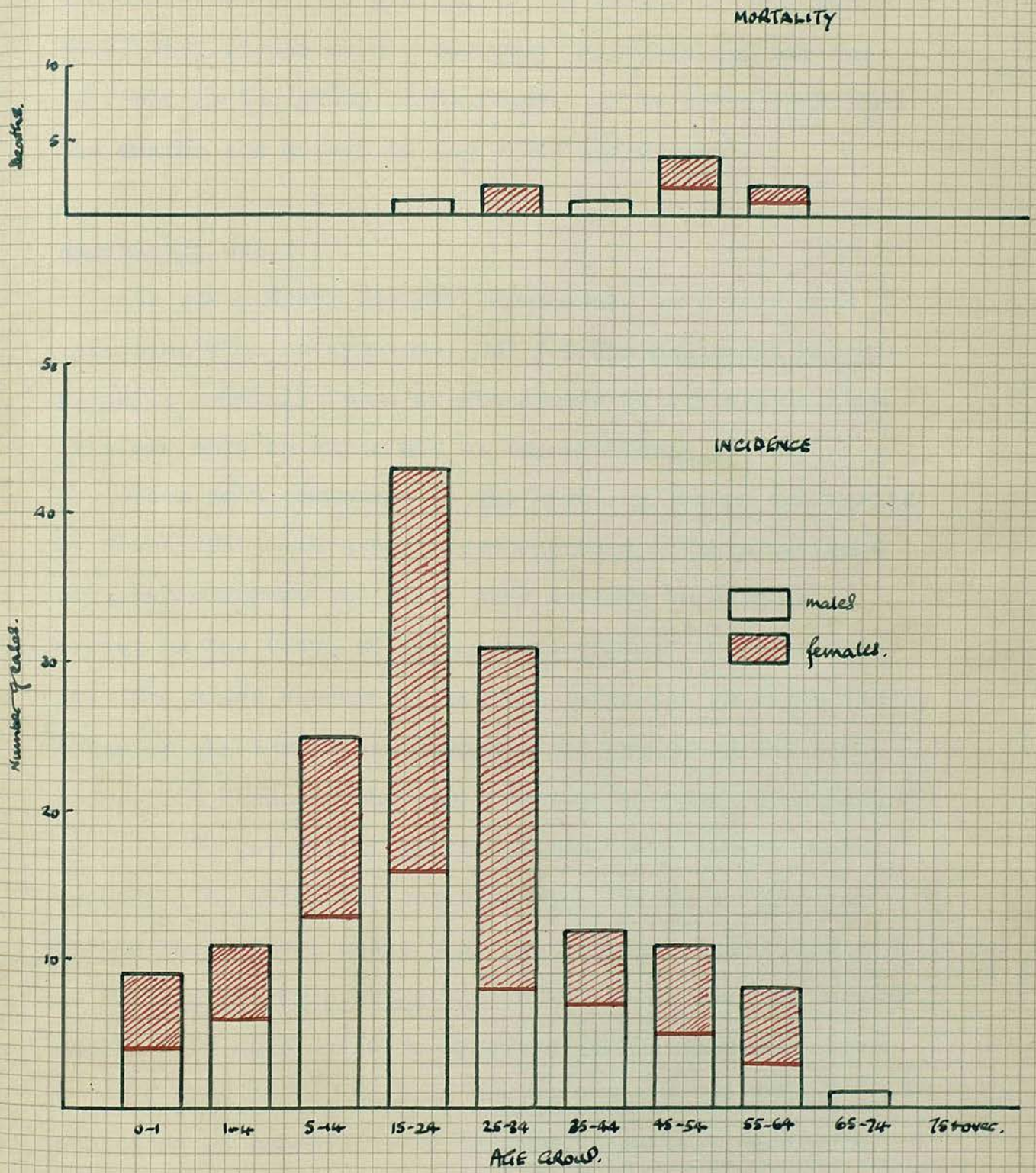


FIGURE 30: Age and sex incidence and mortality of BACILLARY DYSENTERY in Tumutumu Hospital. (153 cases).

in the short dry season.

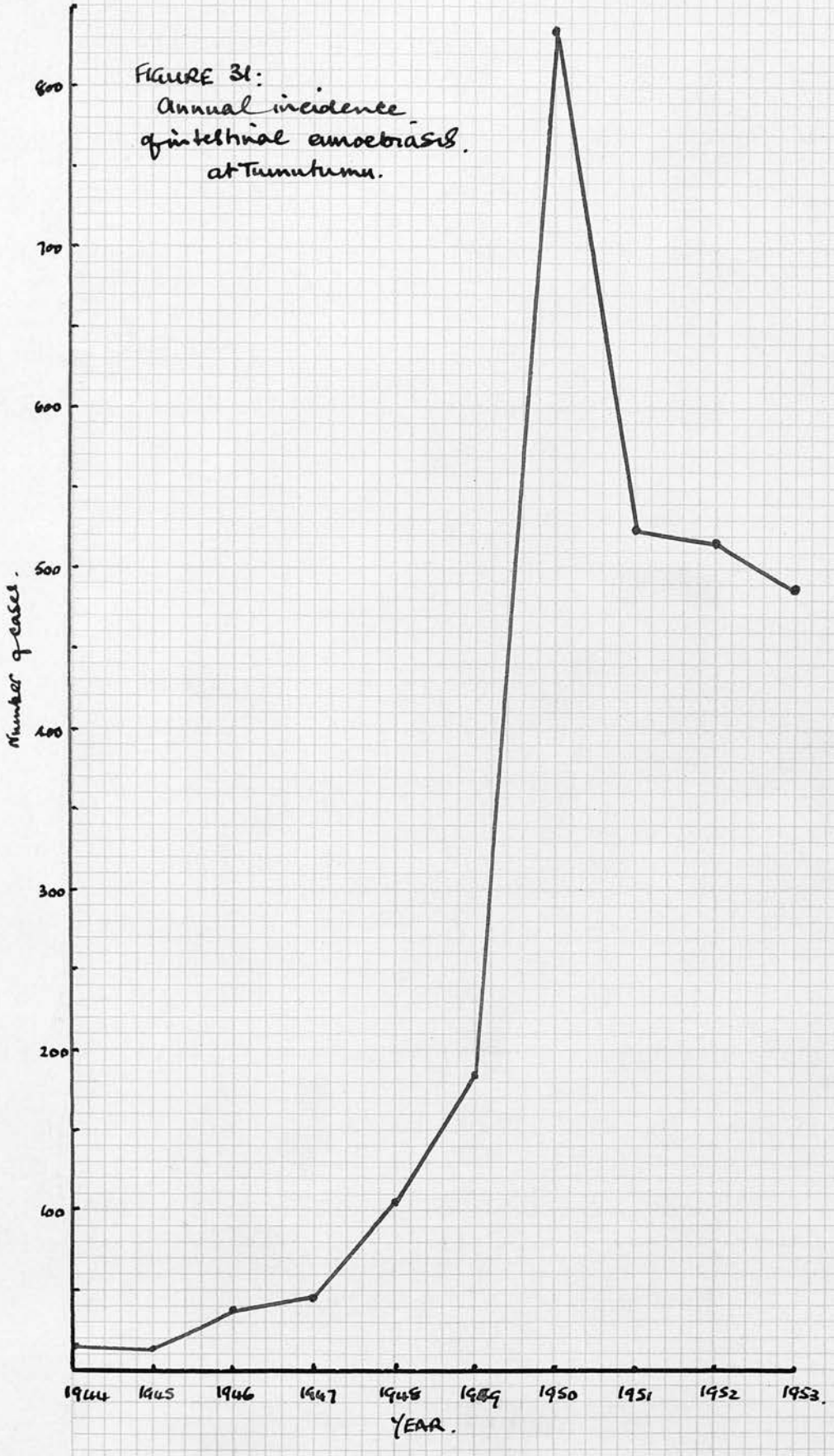
The sex and age incidence is shown in Figure 30. The incidence of the disease in the female is well over twice that in the male. The peak incidence for any age is found in the group 15-24 years. It is noteworthy that the deaths are mainly in the older age groups.

Amoebiasis(046):

In South Nyeri District amoebiasis is a very mild infection with no symptoms, and yet the Entamoeba histolytica is commonly found in the stools in its cystic form. This can only be explained by the existence of the protozoon as a commensal in the bowel, a theory maintained by Hoare(1949) and other recent workers. The prevalence of amoebic infection in any area depends to a large extent on the views of the medical officer in charge of it. The older concept of amoebic infection in which the organism was always pathogenic still dominated the text-books, and leads to the employment of thorough treatment in order to get rid of the infection. The modern theory according to which the organism can live as a commensal in the human bowel means that the patients discovered to have Entamoeba histolytica in the stool are not treated unless they have definite symptoms due to this infection.

If this is so, we have now to explain the annual incidence of amoebiasis in Tumutumu Hospital inpatients shown in Figure 31. There was a definite rise in incidence from 1944 to 1949, followed by a phenomenal rise in 1950 which was sustained at a reduced level for the rest of

FIGURE 31:
Annual incidence of intestinal amoebiasis at Tumuturumu.



the decade. Now it is recorded that in 1950 there was an epidemic of amoebic dysentery in the Boarding Schools at Tumutumu and this explains the sudden rise in the number of cases. No stool cultures were done, the diagnosis being made on the examination of wet slide preparations of the stool. The Entamoeba histolytica was found in both active and cystic stages and so amoebic dysentery was diagnosed. In retrospect it seems much more likely that this was in fact an outbreak of bacillary dysentery for sharp epidemics like this are not typical of amoebic dysentery. The amoebae appeared in the stool as a result of the irritation of the bowel and intestinal hurry which flushed out the normal commensal organisms of which the Entamoeba histolytica was one.

The seasonal incidence of these cases is shown in Table XLIX. The incidence was maximal in the second quarter of the year, that is, in the long wet season.

SEASON	SHORT DRY	LONG WET	LONG DRY	SHORT WET
NUMBER OF CASES	575	933	762	492

Table XLIX. The seasonal incidence of amoebic dysentery.

The sex and age incidence of the disease is given in Figure 32. The sex incidence is almost equal, and the age group 15-24 years contains the greatest number of

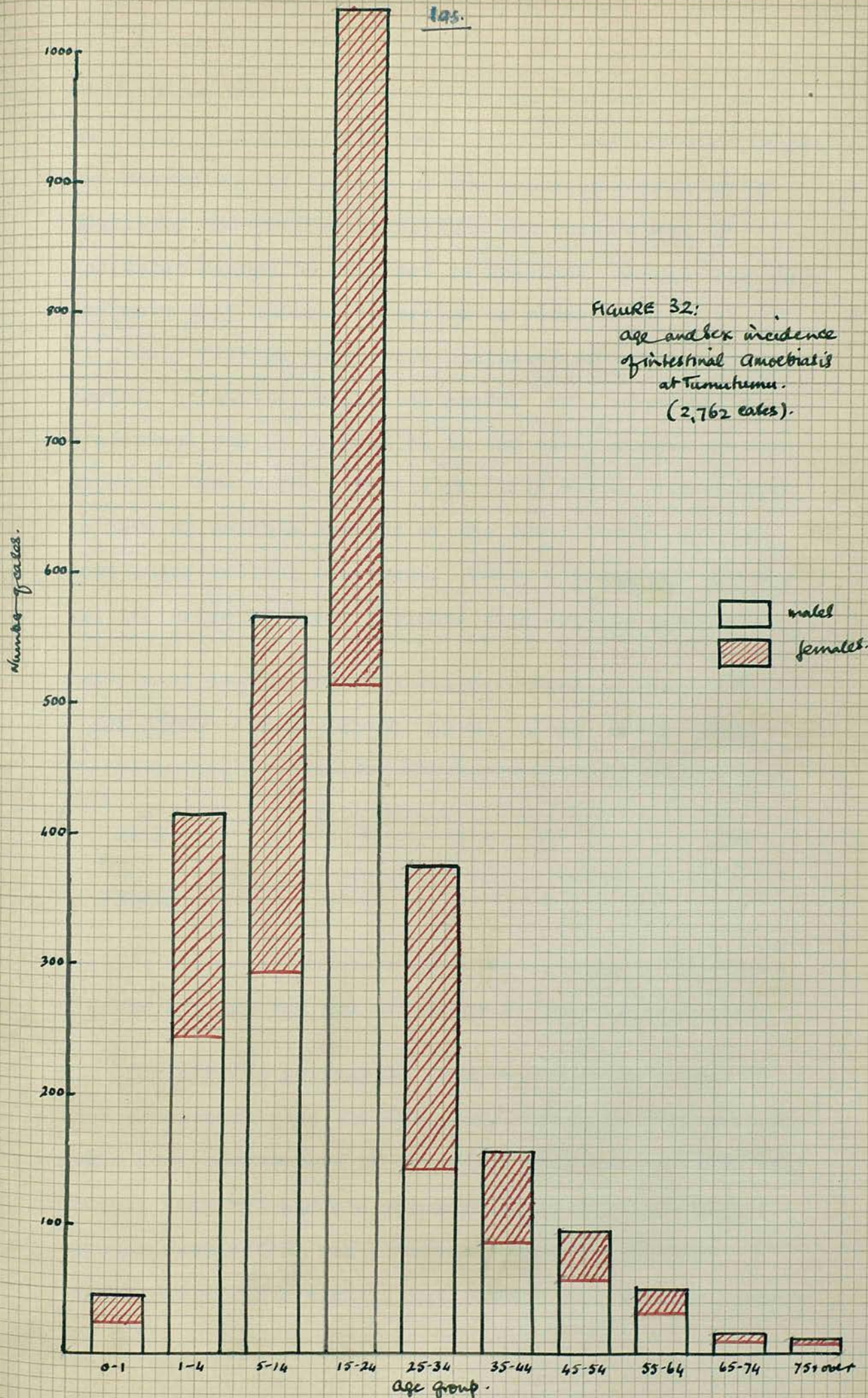


FIGURE 32:
age and sex incidence of intestinal amoebiasis at Tumutumu.
(2,762 cases).

cases since most of the cases in the Tumutumu School outbreak were aged 15-18 years. Unfortunately our figures are untrustworthy because of the probable confusion of bacillary and amoebic infections and these rates of incidence cannot be regarded as accurate, though they do indicate that amoebic infection is widespread.

Only fifteen cases were diagnosed as suffering from amoebic hepatitis in the ten years. This diagnosis was a clinical one, as it must be in the early stages of the disease. One case, a female of fifty years, was thought to have an amoebic abscess of the liver but it settled down under medical treatment. Table L gives the sex and age incidence of these patients with amoebic hepatitis.

AGE GROUP	15-24	25-34	35-44	45-54	55-64	TOTAL
MALE	3	2	3	1	1	10
FEMALE	1	1	1	2	0	5

Table L. Age and sex incidence of amoebic hepatitis

The African patient is just as liable to suffer from amoebophobia as the European. Often in 1952 Africans would come complaining of abdominal pain and say that they thought they had amoebic cysts in their stools. Sigmoidoscopic examination was invariably negative in its results in these patients, but nothing but emetine therapy

would satisfy them. The true position of amoebiasis in most places in the tropics may be summed up in the words of Murgatroyd(1951): "Indigenous tropical populations may have high infection rates with few clinical cases."

Diphtheria(055)

Diphtheria was first reported in Kenya in 1924 in an editorial in the Kenya Medical Journal. It was seen in three Asian patients, three African patients and one European. It is still seen in Asians and Europeans, but it appears to be very rare in Africans. It is said to be a mild disease amongst Africans(Lewis,1942) and may be missed for this reason. Whenever African populations have been Schick-tested a large proportion have been found to be Schick-negative. In Nairobi recently Singleton(1950) obtained the following results after Schick-testing three groups of schoolchildren:

RACE	NUMBER TESTED	SCHICK NEGATIVE
European	71	39.4%
Asian	799	72.0%
African	686	88.6%

These figures suggest that the African child does meet diphtheritic infection. It must occur in subclinical form since it so rarely diagnosed. The indigenous form of the organism in Kenya is the mitis strain and it produces a lot of membrane, but little toxaemia(Kenya Medical Department,1949).

Whooping cough(056):

There is no specific word for whooping cough in the Kikuyu language, and when trying to elicit a history one has to imitate the whoop in order to be sure that the mother really understands what she is being asked. Often after such an attempt the mother will smile and say in English, "Oh, whooping cough ?".

Whooping cough is with us every year, and all the year round. It is probably our commonest childhood infection amongst the Kikuyu, and one of the more fatal ones of those which we see in hospital. However, as with so many of the diseases we see, it is impossible to obtain accurate figures of incidence amongst the community. We know that many cases of measles, for instance,are nursed at home for we have seen such cases when we have been visiting the homesteads, and what is true of measles is probably also true of whooping cough.

The annual incidence and mortality is given in Figure 33. They show no definite correlation with the climatic data over the ten years of this study. The disease shows no definite seasonal incidence for the occurrence of cases is spread more or less uniformly over the twelve months of the year.

Figure 34 gives the age and sex incidence and mortality of whooping cough. The incidence is equal in the

FIGURE 33: Annual incidence and mortality of Whooping Cough.

two sexes. The age group most affected is the 1-4 years group in which sixty-seven per cent. of the cases occurred. Seventy-nine per cent. of the cases were under five years of age.

The death rate is sixteen per cent. in this series. The causes of death in our cases were as follows:

Bronchopneumonia	74 cases
Gastro-enteritis	3 cases
Pulmonary tuberculosis	1 case

Lewis(1942) notes that negroes appear to succumb more readily to the complicating bronchopneumonia in whooping cough than white persons do, but he suggests no reason for this. In the present series, malnutrition was probably a very potent factor in determining the mortality of the disease though it is very difficult to produce statistical proof for this.

Plague(058):

The presence of plague was not suspected in the early days of the European settlement of Kenya(Hunter,1925). The first case to be reported was in Nairobi in 1902 and this was followed by an epidemic of seventy cases in the Indian bazaar area of the city. The type of the disease was bubonic plague, which is the usual type found in East

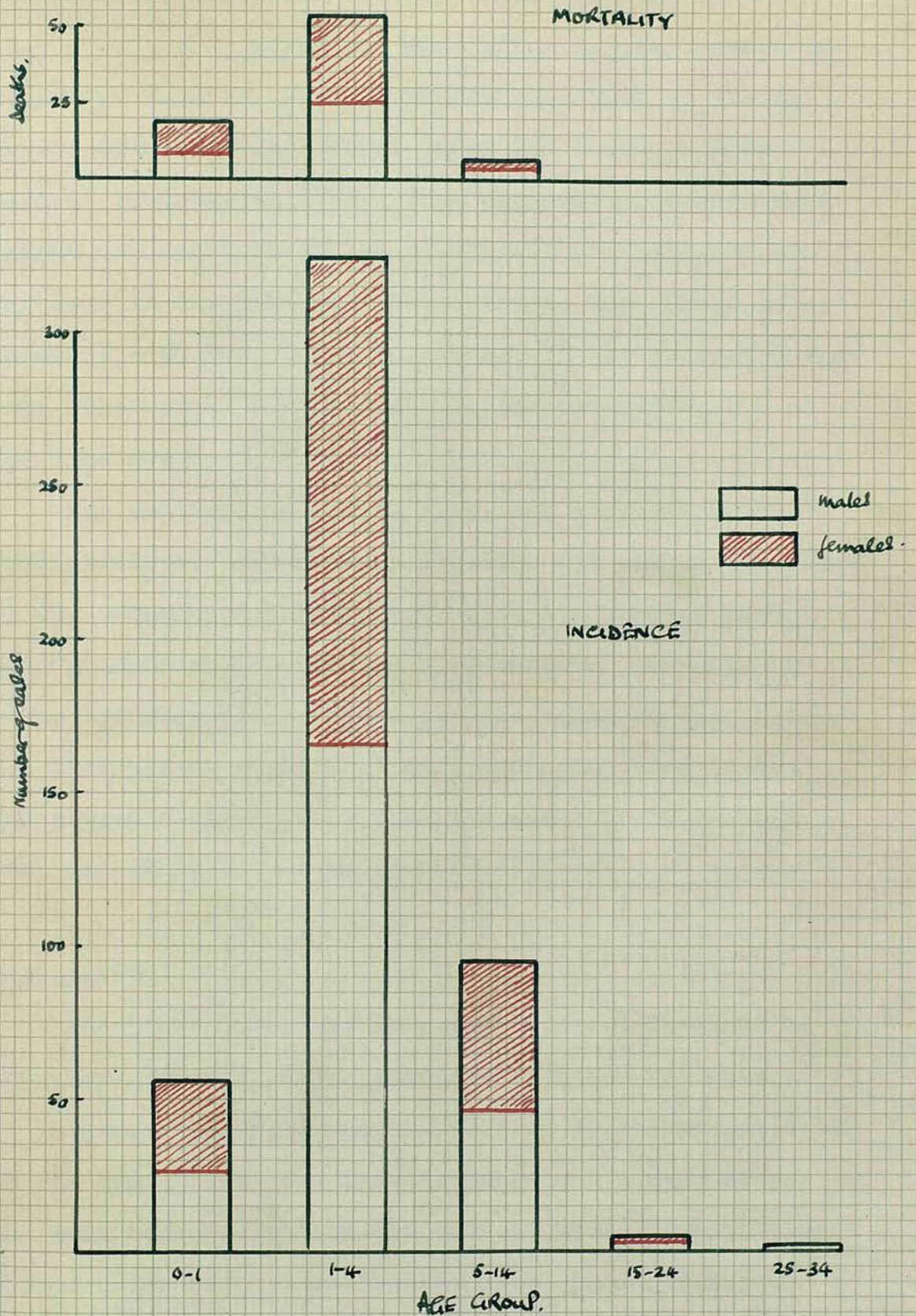


FIGURE 34: Age and sex incidence and mortality of WHOOPING COUGH. (481 cases).

Africa. The reservoir was identified in 1921 as the Rattus rattus kijabius and the Rattus rattus frugivorus. Recently, however, some doubt has been cast on the rat as the primary reservoir of infection in Kenya(Kenya Medical Department,1952). Some eight hundred rats were caught and examined in the old silent plague focus at Kerugoya in the Embu District and none were found to be infected with the plague bacillus. It was suggested that some other small rodent might be the reservoir, but so far none has been identified.

The rat is said not to have been known in South Nyeri District before the year 1912. It was alleged that it was introduced in this year with the baggage of a lady missionary who arrived at Tumutumu. There is no record of when plague first was diagnosed in the district but there is no doubt that it is endemic there to-day and sporadic cases occur like the one seen in Tumutumu Hospital in 1947 in a male of forty years.

Leprosy(060):

The present leprosy home was built at Tumutumu in the year 1933 and can accommodate eighteen patients. It is constantly full and has held up to thirty patients at one time. Patients come to it from all over Kenya, and more especially from the coastal area. During the period under review two hundred cases were discharged which represents a rapid turn-over of cases only made possible by the recent introduction of the sulphone drugs. With these drugs patients can be discharged to

outpatient treatment much more rapidly than previously.

The case records of the leprosy patients were not complete and it was impossible to analyse them along the usual lines. We are fortunate, however, in having the results of a leprosy survey of Kikuyuland which was carried out in 1948 by Dr Ross Innes, the Interterritorial Leprologist. In South Nyeri District he found an incidence of three cases of leprosy per thousand of the population(Innes,1948). Therefore in South Nyeri District there should be about 550 cases of leprosy.

Leprosy is believed to have come to Kenya from a reservoir of infection in the heart of Africa. It spread from the Congo region through Uganda to Kenya, where it is now most prevalent around Lake Victoria Nyanza and at the coast(Innes,1949). The incidence in Kenya is, however, much less than in the other two East African territories(Innes,1950).

The Kikuyu word for the disease is mang'u,which is a word of unknown derivation.

Tetanus(061):

Tetanus was recognised by Hippocrates who crystallised his experience in the famous aphorism, "Convulsions following a wound are fatal." Since the disease is associated with cattle in Kikuyuland, it has presumably been present from time immemorial for the wealth of the Kikuyu has always been his cattle. The Kikuyu word for the disease is mung'ara, which means the disease which produces thirst. The word is derived from the verb

kung'ara, to be thirsty. The name thus embodies the clinical observation that dehydration frequently accompanies tetanus unless care is taken to see that the patient gets enough water to drink. In Swahili the disease is called pepo punda, which is also the name of an evil spirit. The disease was believed to be due to an evil spirit which took possession of the body of the patient and tortured it by producing spasms and convulsions.

The infection may enter the body in at least three ways. It may enter through wounds made by gardening knives(pangas) or hoes(jembes). It may enter through burned skin surfaces, or it may find its way in through ulcers or open sores on the feet. In many cases all that can be found as the portal of entry is the hole left by the chigger flea(Tunga penetrans) after the female has discharged her eggs, and it is probable that contamination of these holes around the toes with dust and cow dung is responsible for a great many of the tetanus infections seen in the hospitals in East Africa. One unexpected source of infection occurred in the practice of a colleague(Irvine,1949). In this case tetanus followed a Kondoleon operation for lymphoedema of the leg. There was a mild degree of lymphostatic verrucosis and spore-infected material must have been buried amongst the verrucose skin and have been taken into the tissues by the knife at operation.

Clostridia tetani must be widely distributed in the Kikuyu environment for every family has its cattle, its

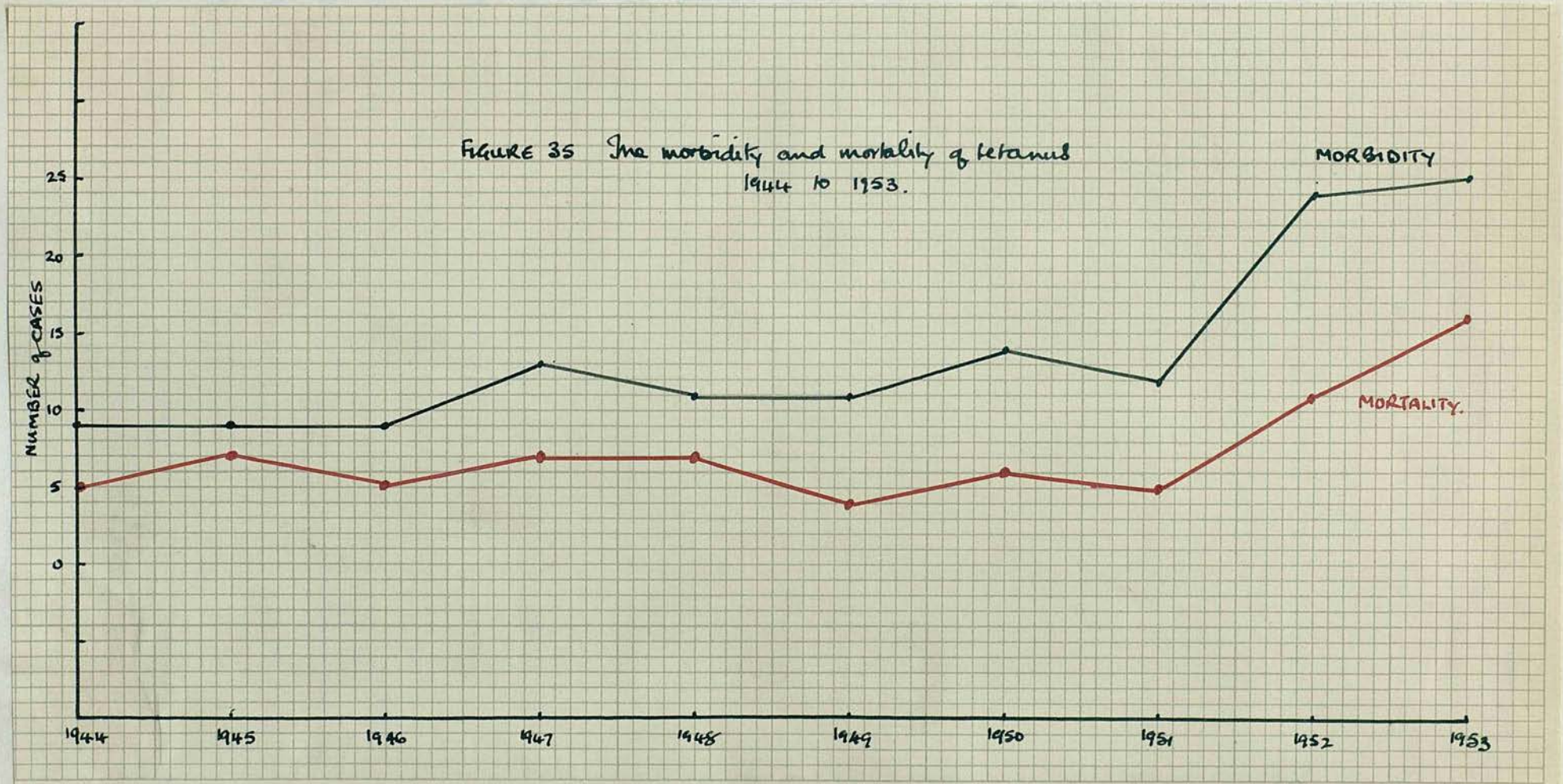


FIGURE 35 The morbidity and mortality of tetanus 1944 to 1953.

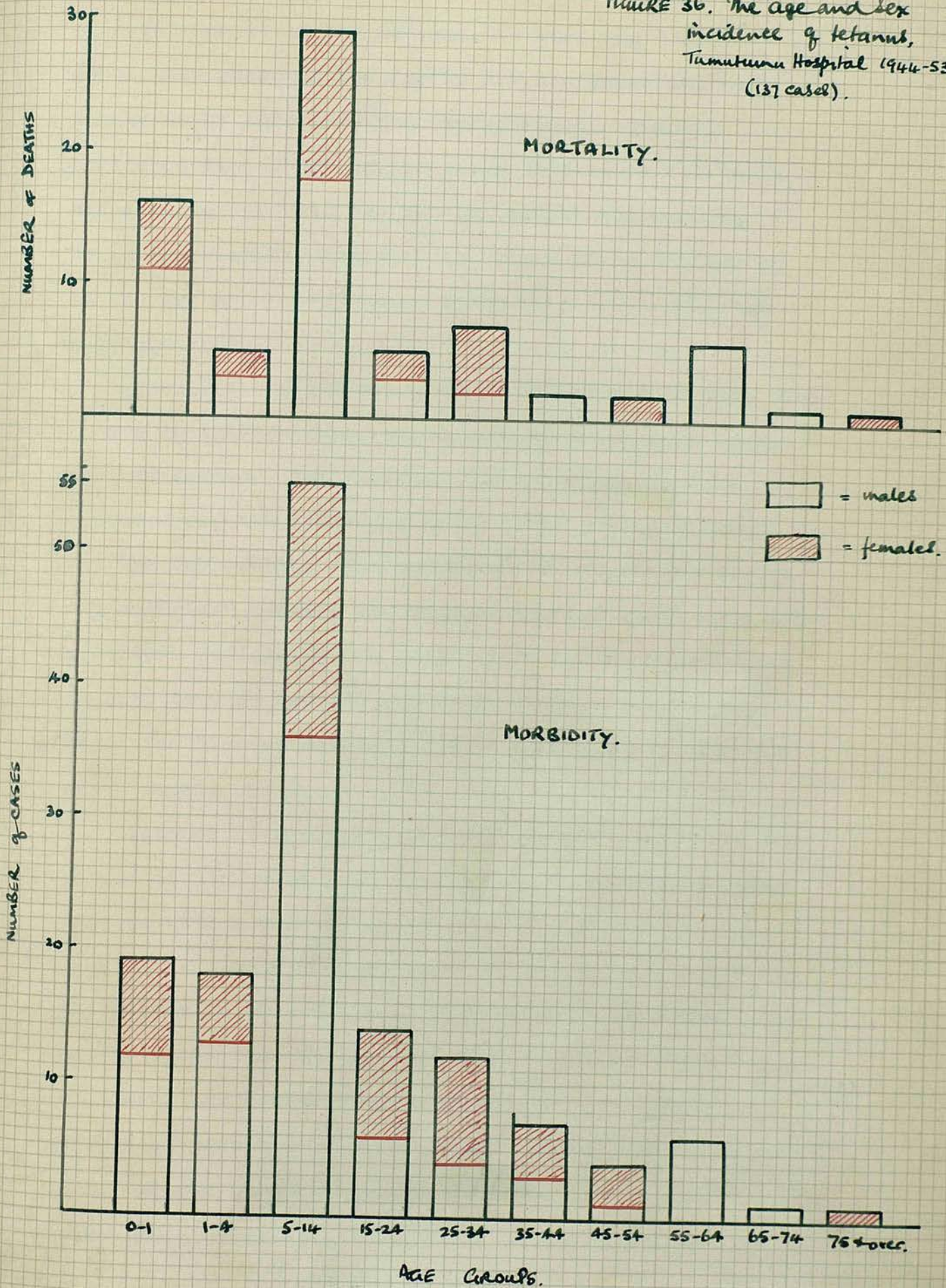
sheep and its goats which all harbour the organism in their large bowel and excrete it in their faeces. The faeces are passed on the paths and roads, and in the homestead. These dry up and the tetanus spores are carried about in the dust and disseminated along the foot tracks and throughout the pasturelands ready to infect their victims.

The annual incidence and mortality of the disease is given in Figure 35. The figures are not large but nevertheless there does appear to be a real increase in incidence for the years 1952 and 1953. We may regard this as a real increase for two reasons: The first is that tetanus is a disease which always results in its victims being brought to hospital and therefore it is probable that we see all the cases which occur. The second reason is that this increase coincides with the increase in wounding due to the activity of the Mau Mau and the security forces in the district. In 1954 the disease was made notifiable in the district, and so a more accurate picture of its incidence should be available in the future.

Our figures are too small to give a reliable estimate of the seasonal incidence of the disease. In West Africa, the disease is found to be commoner in the dry dusty months when the dried faeces are more readily disseminated by the wind(Jelliffe,1950).

The age and sex incidence is given in Figure 36.

FIGURE 36. The age and sex incidence of tetanus, Tumutumu Hospital 1944-53 (137 cases).



There is a preponderance of males which is only to be expected for it is the men and the boys who herd the cattle and sheep of the family and are therefore more likely to be infected from their faeces. The age incidence is highest in the group 5-14 years for it is the children of this age who do most of the herding. It is interesting, however, to note that in Britain it is the age group 5-20 years which is chiefly affected too(Cole,1951).

One of the distressing types of tetanus is that which occurs in the newborn. There were thirteen such cases in this series. The earliest day on which symptoms appeared was the fifth day after birth, and the latest was the fourteenth. The infection is introduced by the pagan African midwife who anoints the umbilical cord with a mixture containing cow dung. This can be expected to contain tetanus bacilli and their spores, and in some cases the disease develops and in most cases causes the death of the child.

Tetanus is a disease that the Africans are very much afraid of, and with good reason for it is a distressing disease with a case fatality rate of fifty-three per cent.. It caused 4.4 per cent. of the total deaths of the decade in this series. Prevention is by immunisation and by protection of the feet from injury by the wearing of shoes. As health propaganda has more influence it should be possible to dissuade the people from using cow dung for the plastering of houses and in maternity practice.

Anthrax(062):

Anthrax is generally believed to be an ancient disease. It is possible that the "grievous murrain" of the cattle which constituted the fifth plague of Egypt was an outbreak of anthrax(see Exodus 9. 3). From whence it came to East Africa is not known. There is no word for the disease in Swahili, the language of the coast, and so it is possible that it did not originate there, but came down from the north with the herds of cattle brought by the immigrant peoples as they moved south. The Kikuyu name for the disease is muriru, which is related to uriru, a calamity or catastrophe.

In East Africa anthrax is chiefly a disease of cattle (Carmichael,1952). The Kikuyu contracts the disease from his cattle by contact with those that have died from anthrax. He has no fear of infection from a dead cow. He will skin and dismember the carcase and invite his friends to a meat feast which may result in an outbreak of intestinal anthrax. Or he may carry the infected meat or hides home on his shoulder where they come into contact with the skin of his face and neck producing cutaneous anthrax. He may then cure the hides and use them on his bed, and again he may come into contact with any anthrax spores which lie dormant in the hide or the hair, and cutaneous anthrax may result.

Anthrax appears to be a much less severe infection in the African than it is in the European. Raper(1953) says that "to one who has seen the disease(cutaneous anthrax) in Bradford wool workers, the mildness of the

cases seen in Uganda is very striking." In several of the annual reports of the Kenya Medical Department it is suggested that the African had an immunity to the disease. For example the 1952 report states: "The older generation of Africans in the Central Province(of which the South Nyeri District forms a part) was undoubtedly almost immune to anthrax infection." But it goes on to say that "the price of immunity, of course, was the death of many non-immune children." The total cost of that price we shall never know.

The control of anthrax is primarily a public health problem, and the reduction of its incidence in South Nyeri District is an achievement of which the Medical Department may well be proud. The curve of annual notifications in Figure 37 speaks for itself. This fall in incidence has mainly been brought about by patient propaganda. Immunisation of cattle has not been possible because of the cost of the vaccine, but in 1951 the African District Council passed a bye-law making it an offence for any person to eat the meat of a cow which had died from disease.

It is generally believed that anthrax is a disease of the wet seasons of the tropical year. With the coming of the rains the anthrax spores in the pasture-lands germinate and the cattle are infected, and then the human cases occur(Gilbert,1935). In Table LIII the total number of notifications for the years 1947 to 1953 are analysed for seasonal incidence. They do not show a very close relationship to the wet season. The

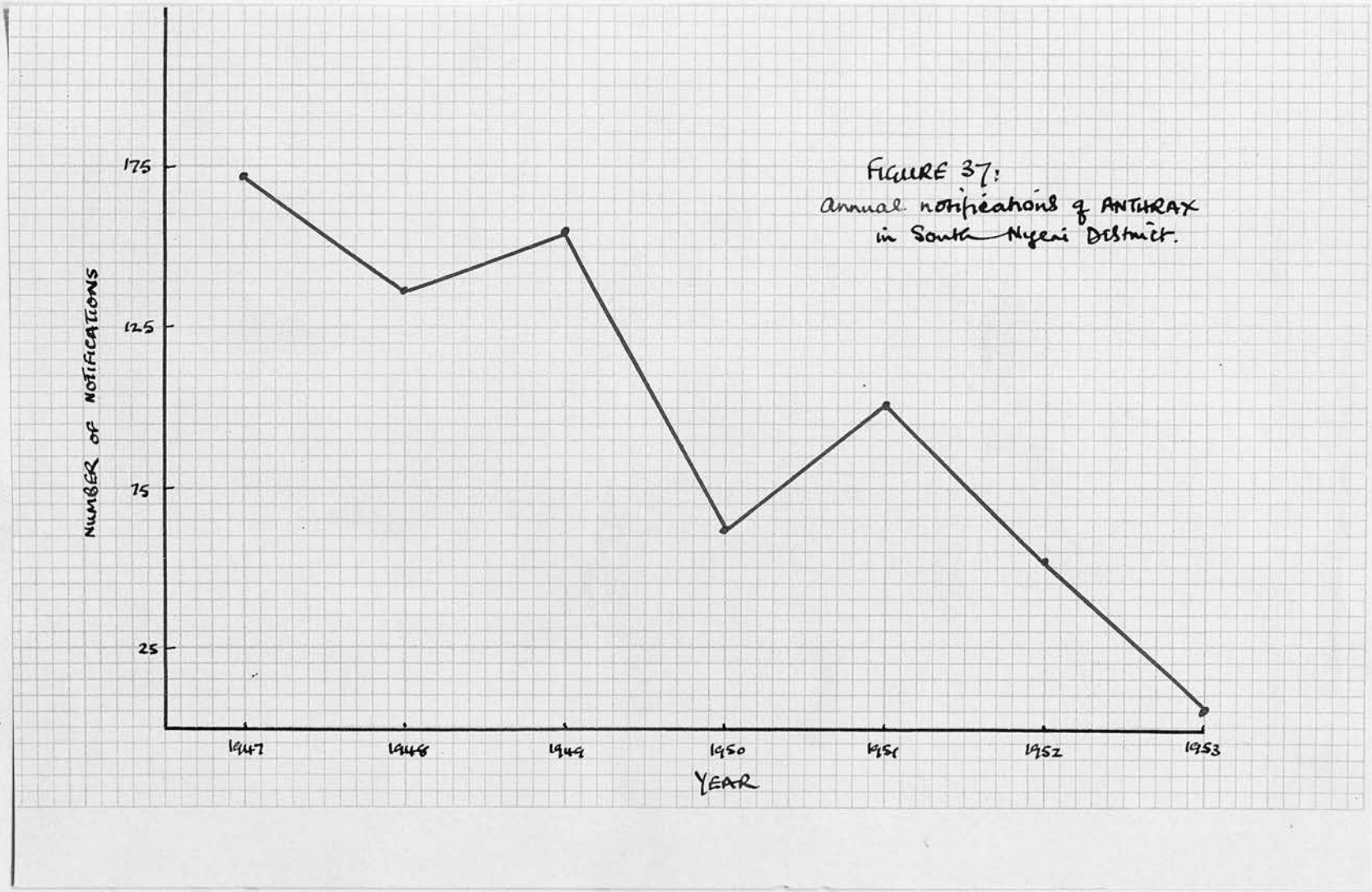


FIGURE 37:
Annual notifications of ANTHRAX in South Nyeri District.

greatest number of cases occurred in the long wet season and the least number in the short wet season.

SEASON	SHORT DRY	LONG WET	LONG DRY	SHORT WET
CUTANEOUS CASES	188	224	187	88
INTESTINAL CASES	0	44	56	0
TOTAL	188	268	243	88

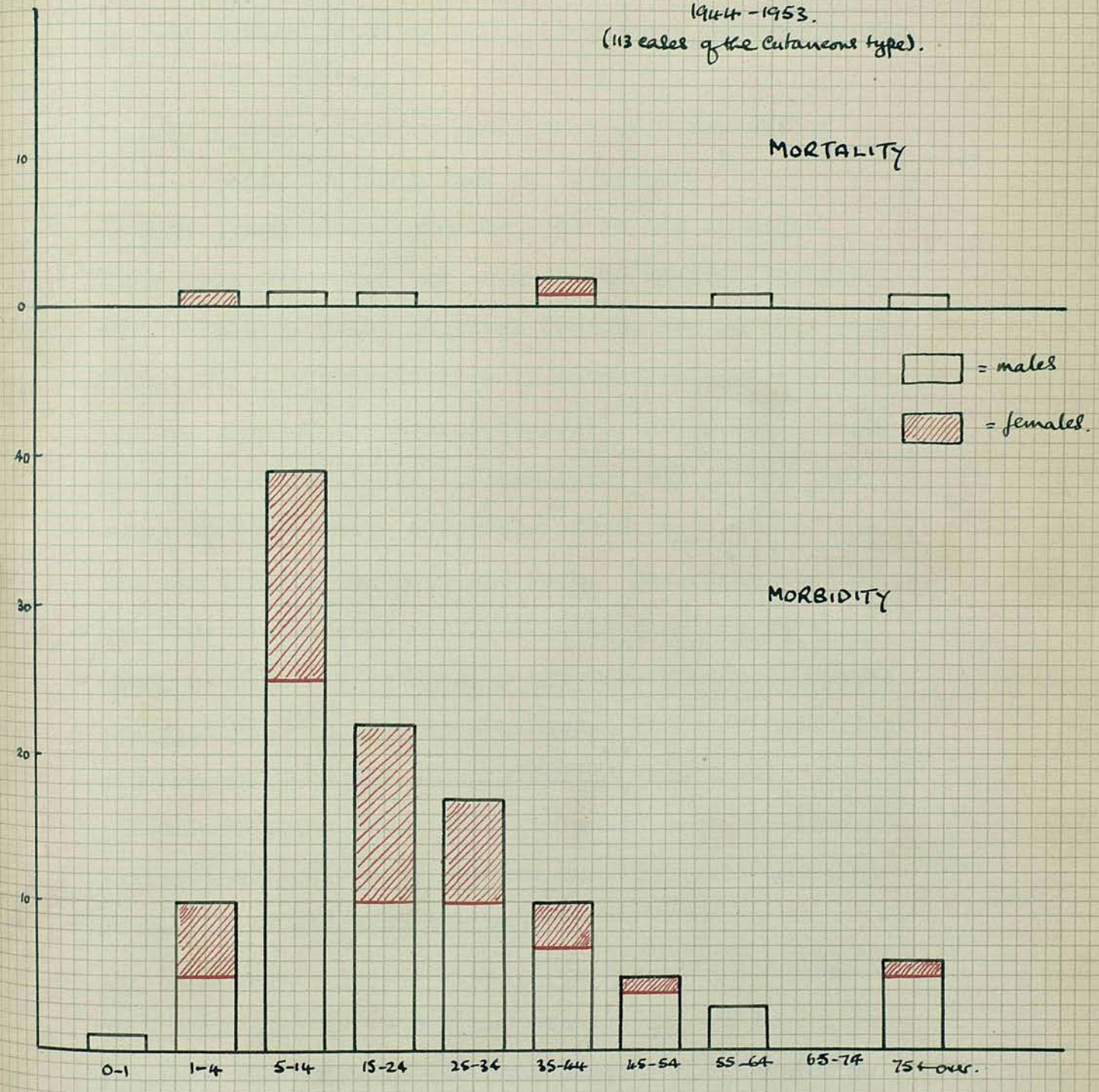
Table LIII. The seasonal incidence of anthrax notifications.

The commonest form of the disease seen amongst the Kikuyu is the cutaneous or malignant pustule, as it is in Britain. The intestinal form is the next most common one. The respiratory form has not been recognised in East Africa. Anthrax meningo-encephalitis has been reported at post-mortem from both Nairobi and Kampala (Raper, 1953).

Cutaneous anthrax:

The age and sex incidence of the cases of cutaneous anthrax is given in Figure 38. These were the cases which were admitted to Tumutumu Hospital and thus the figures are lower than for the total number of notifications. There is a preponderance of males for it is the males who have most to do with the cattle whether alive or dead. The age group 5-14 years shows the greatest number of

FIGURE 38:
Age and Sex incidence and mortality of ANTHRAX in Tuamutumu Hospital 1944-1953.
(113 cases of the Cutaneous type).



cases which shows that the boys and girls are eager to help their fathers and carry home the meat and the hide.

Cutaneous anthrax may be contracted by the Kikuyu in three ways:

1. By contact with an infected carcase during flaying or cutting.
2. By contact with infected meat or hides whilst carrying them home or to market.
3. By lying on an infected hide in bed at night.

These ways determine the site of the anthrax lesions and the distribution of these lesions can be seen from Figure 39. Unfortunately only seventy-one of the cases had the site of the lesion recorded in the case notes. By far the majority of lesions were seen on the face where 60.5 per cent. occurred. 80.3 per cent. of the lesions were on the head and neck. The right side of the body was more commonly affected than the left, which is probably related to the fact that more people are right-handed than left-handed. The face, neck, shoulder and arm would be the sites affected as a result of infection during carrying of infected meat or hides, whilst the face, head, buttock and leg would come into contact with hides on the bed.

The case fatality rate of this series of cases of cutaneous anthrax is 6.2 per cent.. It would have been lower if the patients had come earlier for treatment. Many came when they were very ill with marked oedema around the lesions. It is not possible from the scanty information available to correlate the site of the lesions

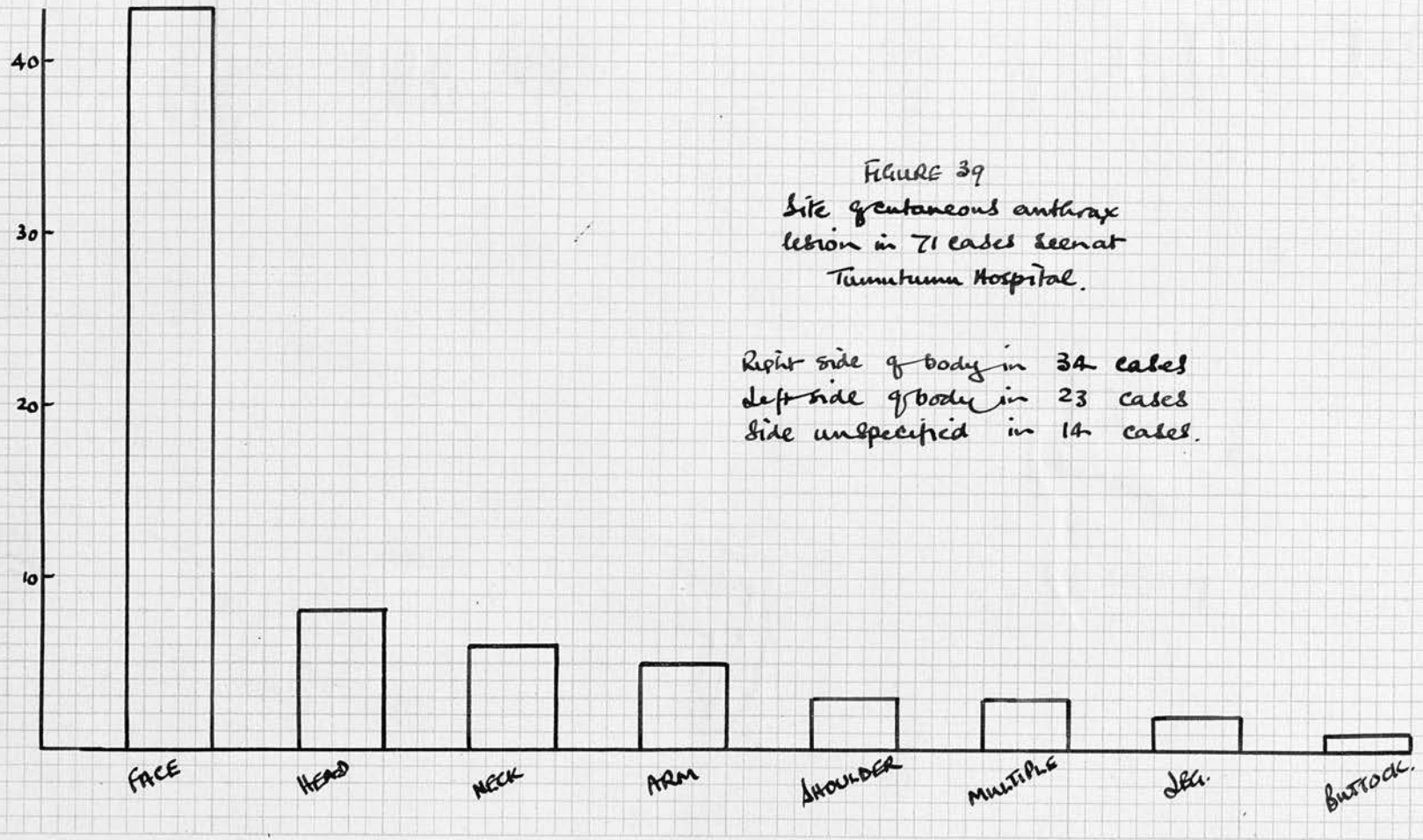


FIGURE 39
Site of cutaneous anthrax lesion in 71 cases seen at Tumutumu Hospital.

Right side of body in 34 cases
Left side of body in 23 cases
Side unspecified in 14 cases.

with the fatality of the cases. The usual experience is to find that lesions on the face and neck have a higher mortality than those on the limbs(Meyer,1951).

Intestinal anthrax:

This is contracted by eating the flesh of a cow which has died from the disease. We have seen in an earlier section that the Kikuyu custom when a cow dies is to invite all the friends and relations of the family to come to a meat feast. The meat is eaten after a very perfunctory cooking. According to the Notification of Infectious Diseases Register there were only five outbreaks of intestinal anthrax in the three years 1951 to 1953. The numbers affected ranged from six to thirty-eight.

One of the interesting features is that thirty-eight per cent. of the cases of intestinal anthrax notified in the three years referred to above were in females. This is an important fact as it reflects the modern change in dietetic habit. Formerly, women did not eat meat for that was men's food, but to-day they are doing so in increasing numbers, which is a very desirable nutritional trend. The incidence of intestinal anthrax and of taeniasis amongst females has therefore a very special significance.

Relapsing fever(071)

This fever was first described on the African continent by Griesinger in 1851(Heisch,1950) when he reported some cases from Egypt. Livingstone(1857) was the first, however, to notice that a fever sometimes followed the bite of the tampan tick(Ornithodorus moubata). The Kikuyu country is regarded to-day as one of the most important endemic centres of tick-borne relapsing fever in East Africa, but the evidence suggests that South Nyeri District has only recently become an endemic centre(Heisch,1950). The notifications of the disease only become numerous after the year 1940 in the district.

The cases seen in Tumutumu Hospital are all due to tick-borne infection and come from certain well-defined foci of infection in the area. Certain homesteads are are endemic centres, and the people there have refused to allow control measures to be carried out until recently. With their removal into one of the new villages it is probable that the infection will be stamped out. Meantime there is no doubt that the incidence of the infection has been decreasing each year. This can be seen from the decrease in the number of notifications in Figure 40. This is due to the patient propaganda of the Health Officer and the recent use of dicophane powder on the floor of huts.

The long wet season contains a few more cases than any other according to Table LIV, but on the other hand the least number of cases occur in the short wet season. Hackett(1951) states that there is usually no seasonal

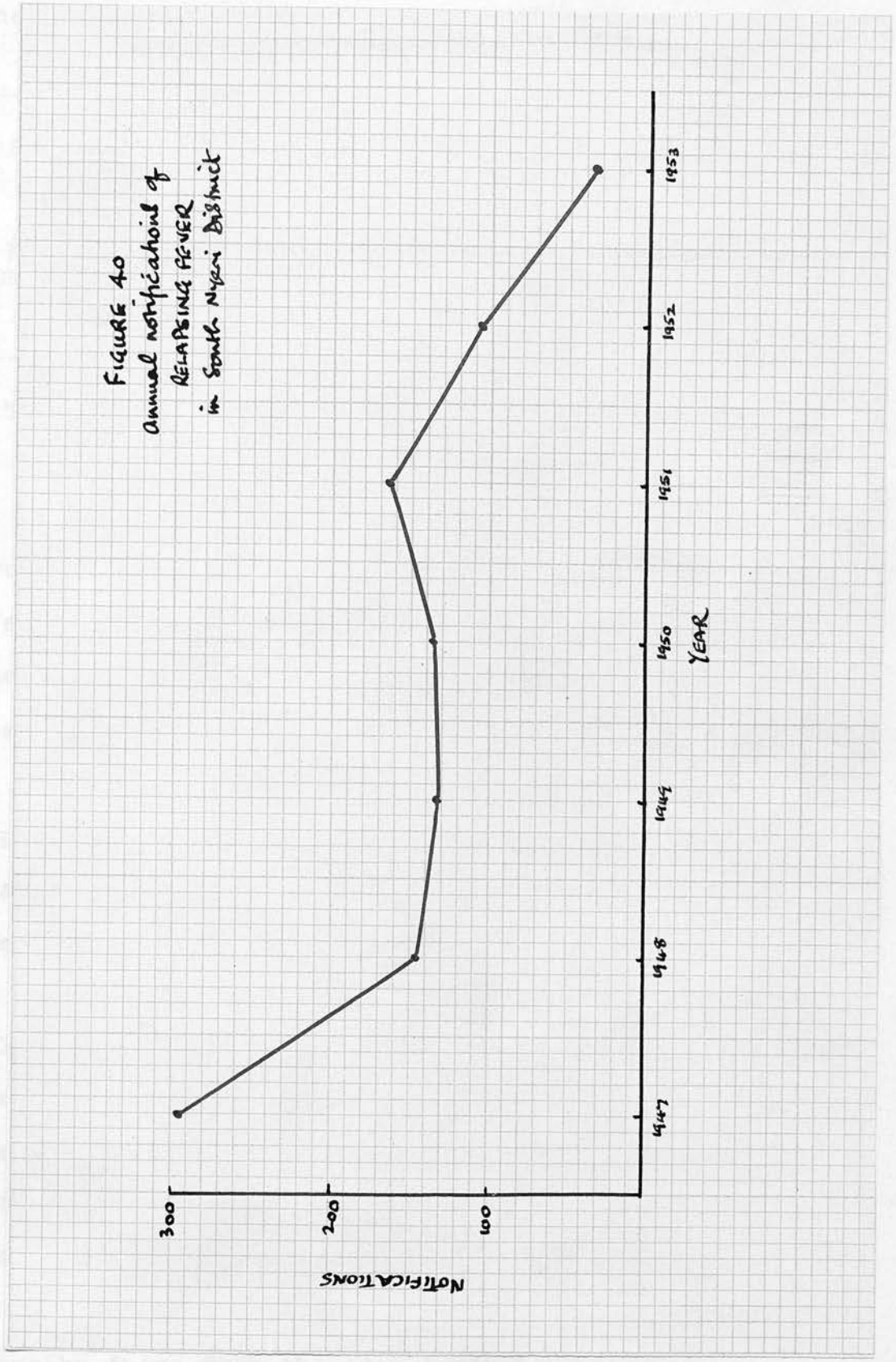


FIGURE 40
Annual notification of
RELAPSING FEVER
in South Nyasi District

variation in incidence, whilst Heisch(1950) found that there was a relationship to rainfall.

SEASON	SHORT DRY	LONG WET	LONG DRY	SHORT WET
NUMBER OF CASES	288	303	213	202

Table LIV. Seasonal incidence of notifications of relapsing fever in South Nyeri District.

The age and sex incidence of the cases discharged from Tumutumu Hospital is given in Figure 41. There is a slight preponderance of females amongst the cases. The age group most affected in this series is the 5-14 years group.

The case fatality rate of relapsing fever in our experience at Tumutumu is 4.5 per cent., and the age most affected is that of females in the 15-24 years age group.

All these cases are of the tick-borne variety of relapsing fever, but it should be remembered that louse-borne relapsing fever has appeared in Kenya. It was seen in the Coast Province in 1945 and is regarded as an extension of the epidemic which began in the Fezzan in 1942 and swept across North Africa in both directions. It reached the Middle East and was probably brought to Kenya by dhows from the Aden Protectorate.

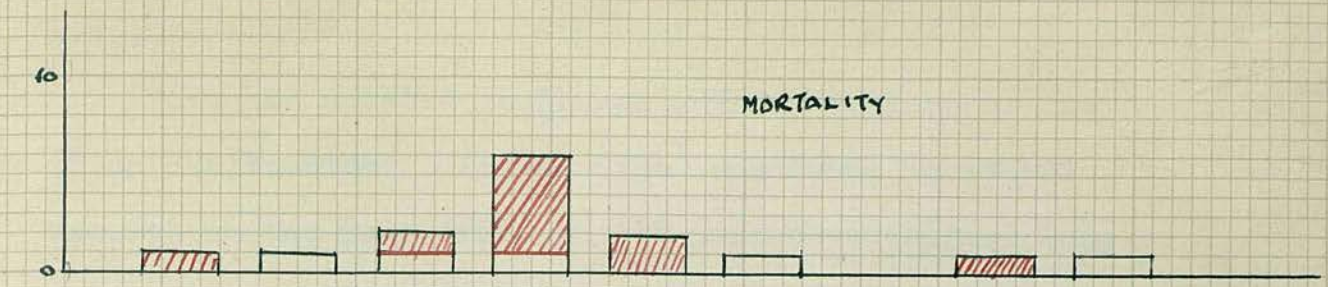
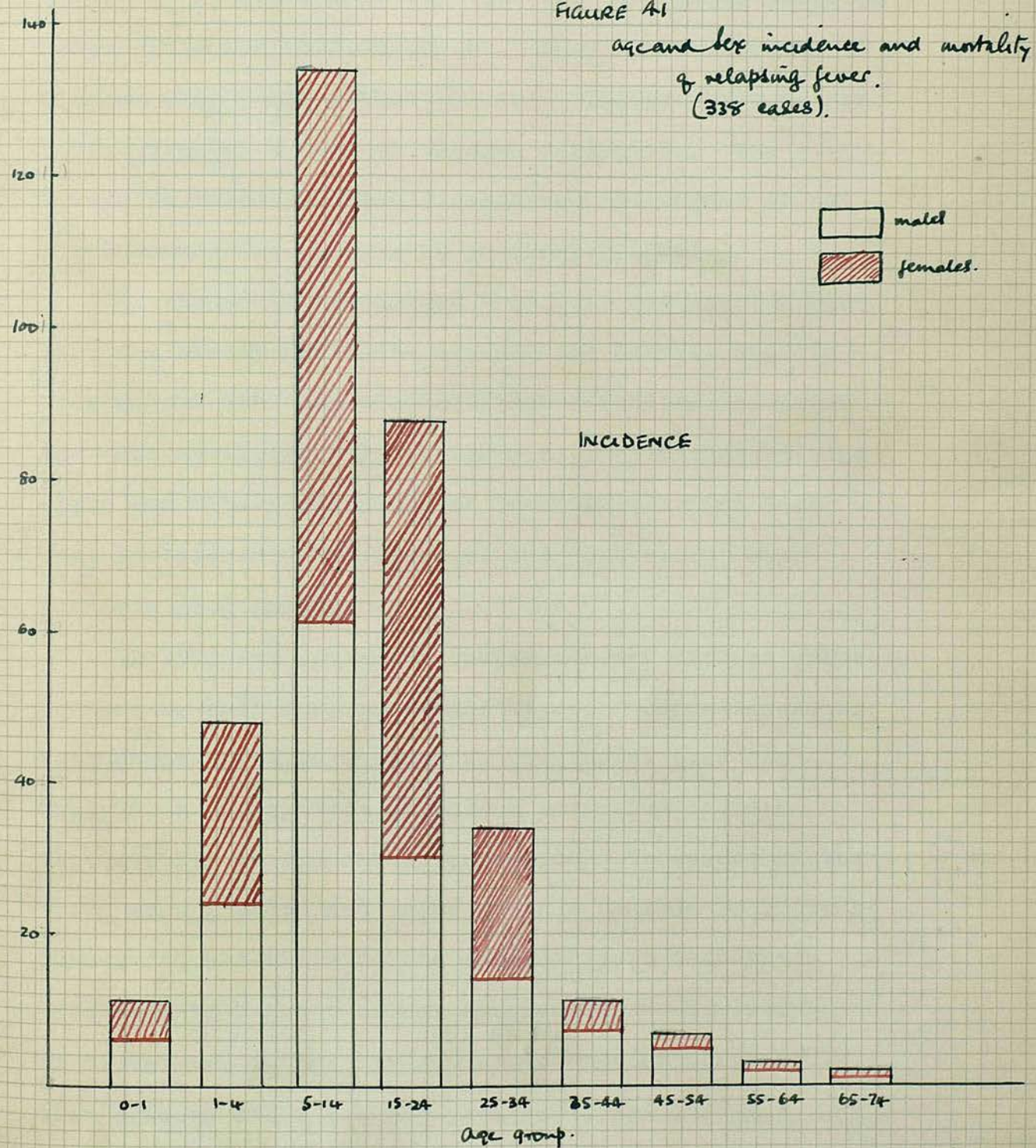


FIGURE 41
age and sex incidence and mortality of relapsing fever. (338 cases).



Yaws(073):

Yaws has existed in Kikuyuland for as long as the tribe can remember. It was first mentioned in annual reports in the year 1905, but it must have existed long before that. Its origin is unknown. The Swahili word for the disease is buba, which is a pure Portuguese word, but it seems unlikely that the Portuguese would be responsible for introducing it. They may have named a disease they found without a name. The Kikuyu word for it is mutukia, a name of unknown derivation. The Kikuyu believed that the disease was the result of an overfondness for the pigeon pea(Barlow,1924).

It was early recognised that this disfiguring disease was widely prevalent amongst the Kikuyu, but its true extent was only realised when effective treatment was made available. Gilks(1923) estimated that between sixty and ninety per cent. of the population of Fort Hall District had the disease, and that every baby suffered from primary yaws.

In 1920 the anti-yaws campaign began and was pressed forward by both Government and Mission medical agencies throughout the Kikuyu country. The agent used was "galyl", a preparation of sodium potassium bismuth tartrate for intramuscular injection. Thousands of the tribe were treated and cured so that by 1924 Dr Philp of Tumutumu could write in his annual report that yaws "has been to a great extent stamped out." In 1931 Dr Gillan wrote that "my own experience at Tumutumu is that primary and secondary yaws cases are uncommon, and

one will sometimes go for weeks without seeing a single case. Tertiary lesions are, of course, very common." He produced evidence in his article to show that this was the common experience of all who worked in the Kikuyu country at that time.

To-day, yaws is rarely encountered. The ninety-three cases of the Tumutumu Hospital series were not described in much detail in the case-notes and so it was not possible to check the diagnosis. In any event, the cases seemed almost all to be in the tertiary stage for there were no descriptions of primary or secondary manifestations. Yaws remains as a good example of a disease which can be almost completely stamped out by adequate and effective treatment. It is also the disease which demonstrated to the Kikuyu the power of hypodermic injections, and explains his almost superstitious faith in drugs given parenterally to-day.

Our small series shows no significant annual or seasonal distribution. The disease showed a slight preponderance of male cases, and was commonest in the age group 25-34 years. There was one case of gangosa in a youth aged 16 years. Gondou was not seen in this series.

Acute poliomyelitis(080):

Acute poliomyelitis was reported around Tumutumu in small epidemics in the years 1921 and 1922(Jex-Blake,1924). There is no doubt that the disease still occurs, but its incidence is difficult to assess. The five cases in this

series gives a very inadequate picture of the incidence for, in any case, they represent only the paralytic cases of the disease. These cases consisted of three males aged 1-2 years, and two females aged 14-and 19 years. The fatal case was seen in the elder girl.

The late effects of poliomyelitis(081) were all children with paralysed limbs. Again it is difficult to assess the incidence of these sequelae, and I have often seen people on the road with a withered leg which was the result of a previous attack of acute poliomyelitis.

Smallpox(084):

Smallpox, according to Lewis(1942), is of great antiquity in Africa, and usually occurs as alastrim which is a mild form of the disease. It is not common in Kikuyuland to-day, though in the past great epidemics have swept through the land, notably in the years 1898 and 1916. In the former year it gave the name to the circumcision age grade of that year which was called mutung'u. This name comes from the verb gutung'a which means to be or make lumpy, a reference to the deep-seatedness of the rash in the skin. Another name for the disease is muthundo from the verb guthunda, to bring forth buds, which is again a reference to the skin rash. It is of interest also to record that the 1898 epidemic of smallpox had political repercussions too. It led to the temporary depopulations of Kiambu District with the result that this area was partly alienated to European settlers under the impression that the land

was unoccupied by any tribe. This alienation of land remained a grievance of the Kikuyu tribe until the matter was investigated by the Kenya Land Commission of 1933 which recommended certain adjustments of land. It still remains a grievance though now without much foundation since adjustments have been made(Leakey,1952).

To-day the disease is under control and apart from one or two small outbreaks is unknown. In 1947 we had three cases from such a small outbreak at Nanyuki in the North Nyeri District. They were a mother and two children who had travelled in a bus with a smallpox case. The mother, aged 35, died, but the daughters, aged 10 and 12 years survived.

Measles(085):

How measles first reached the interior of East Africa is difficult to ascertain with certainty. A clue may be provided by the Swahili word for the disease which is surua. This word is Persian in origin, and may suggest that the disease was introduced to East Africa by the Arabs, who in turn derived the disease, and its name, from the Persians. The Kikuyu word for the disease gives no clue to its geographical origin, but it embodies a pertinent observation. It is called githuku, the spoiler, and obviously refers to the complications which may follow the disease and spoil the patient.

The annual incidence of the disease is given in Figure 42. It shows no biennial periodicity such as was noted in large centres of population in Britain before

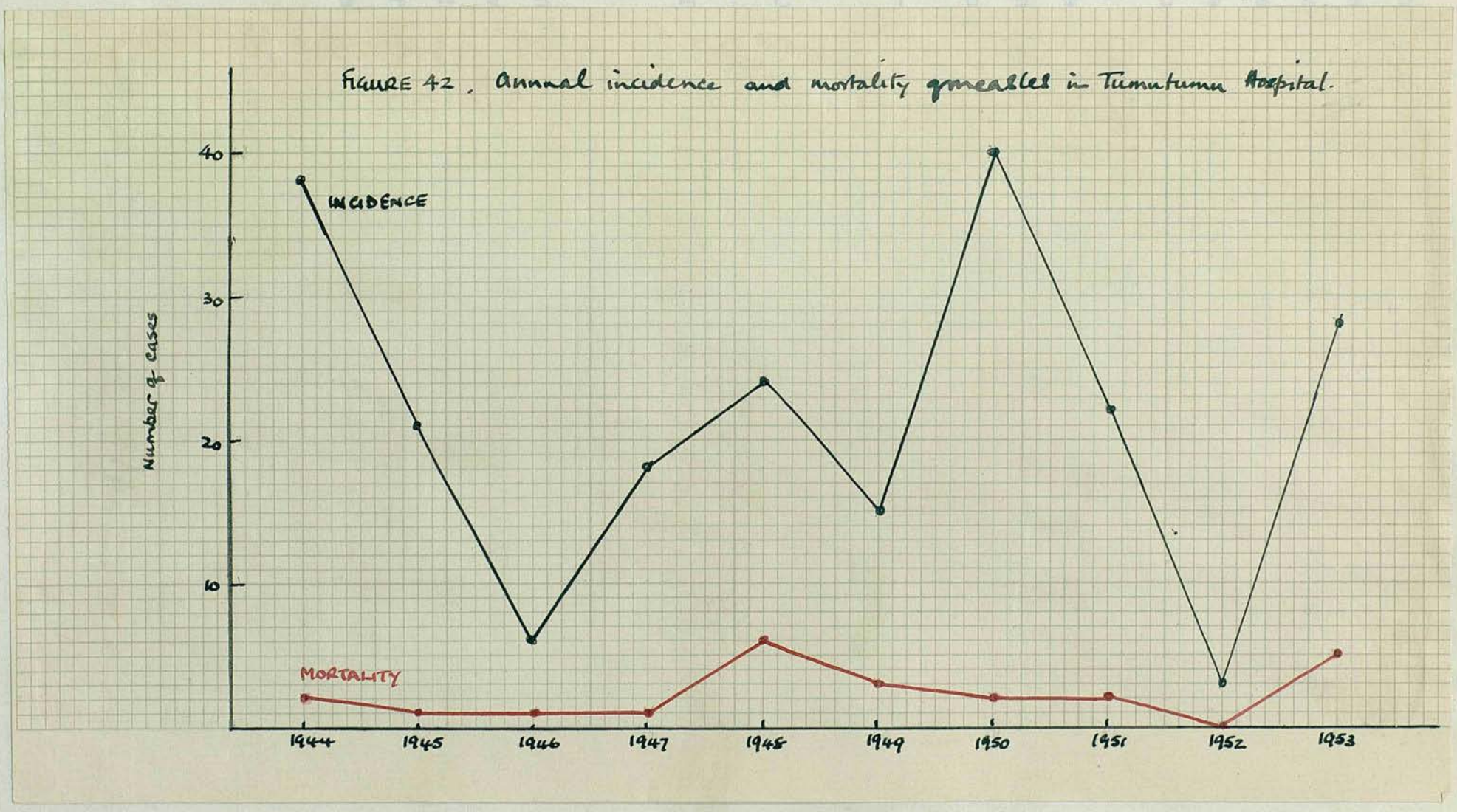


FIGURE 42. Annual incidence and mortality gonocales in Tumutumu Hospital.
Number of cases
40
30
20
10
INCIDENCE
MORTALITY
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953

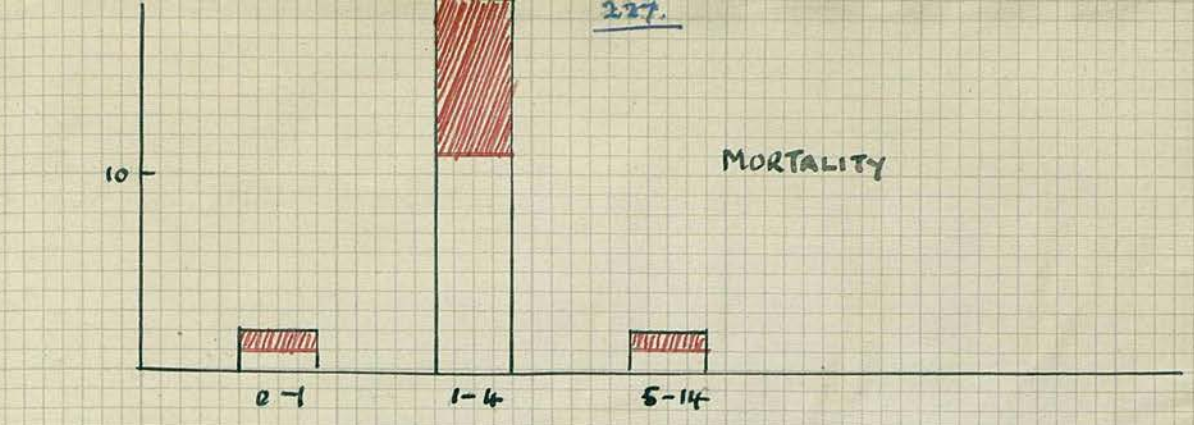
the year 1938. Our numbers are too small and a decade is too short a period to give any true picture of the periodicity of a disease. In any case most of the cases were nursed in their own homes, and those which came to hospital did so because of the occurrence of some complication.

The seasonal incidence of measles is shown in Table LV. There is a slight preponderance of cases in the dry season, but our figures are not large enough to make this significant.

SEASON	SHORT DRY	LONG WET	LONG DRY	SHORT WET
NUMBER OF CASES	60	46	54	55

Table LV. Seasonal incidence of measles in our series.

The age and sex incidence of the disease is given in Figure 43. There is a slight preponderance of males over females, but this may not be significant since our figures are small. The chief age group affected is that of 1-4 years which contains about 67.5 per cent. of the cases and 82.5 per cent. of the deaths.



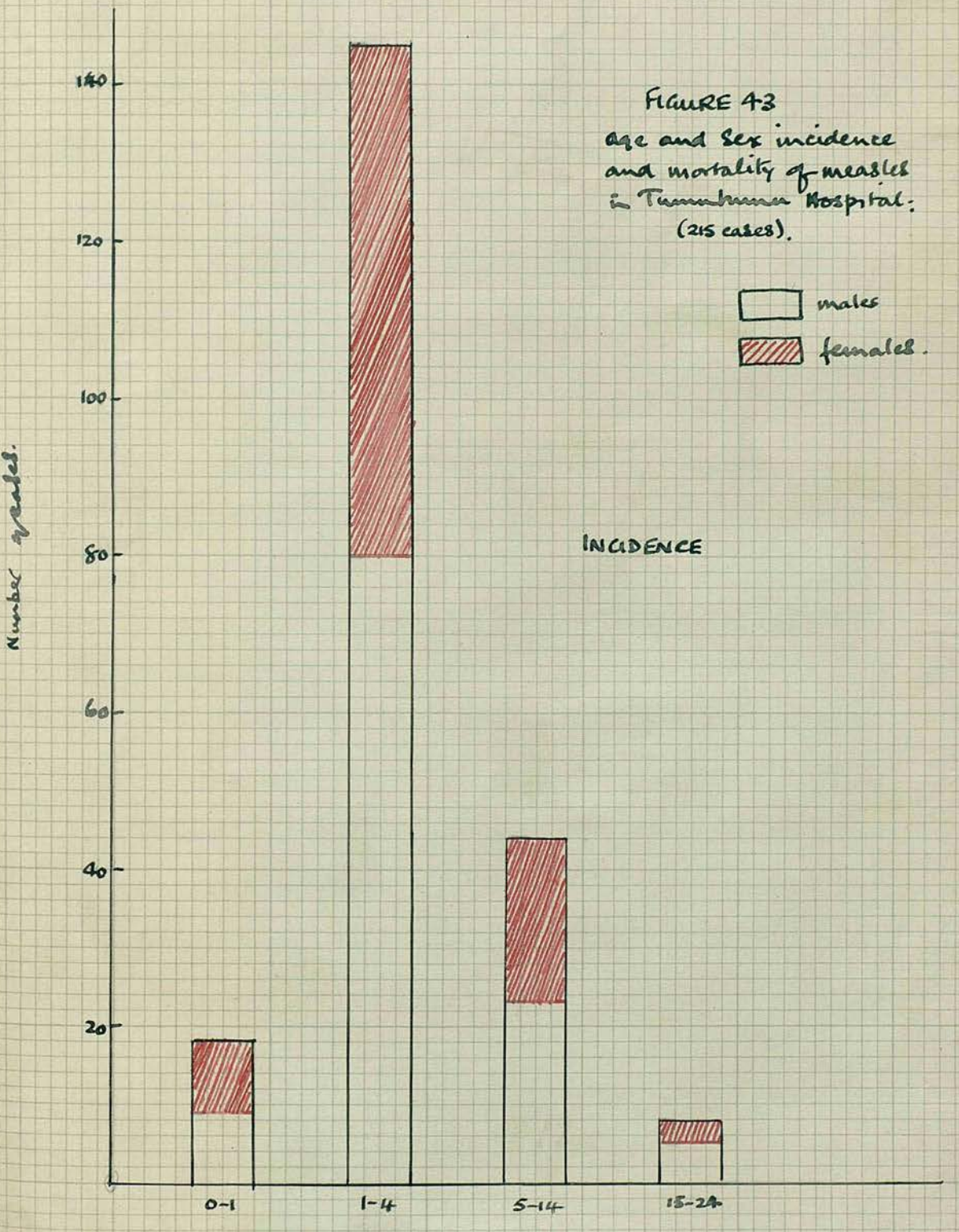


FIGURE 43
age and sex incidence and mortality of measles in Tumutumu Hospital: (215 cases).

males
females.

The case fatality rate in this series was about eleven per cent. The causes of death were as follows:

Bronchopneumonia	18 cases
Gastro-enteritis	4 cases
Cancrum oris	1 case

The latter is the only case of cancrum oris seen at Tumutumu Hospital in the ten years of this study. This lesion appears to be not uncommon in other areas of the tropics. Thus Jelliffe(1952) saw fifty-three cases in two and a half years in Nigeria, which had a mortality of thirty per cent. In his experience in West Africa it commonly occurred as a primary condition in African children.

In assessing the case fatality rate of measles, it should be remembered that many cases were not seen at medical stations, and therefore the figure given above for hospital inpatients is too high as an index of the mortality amongst the community as a whole.

Chickenpox(087):

This is a mild disease which is usually nursed at home, and our hospital figures give no true picture of its real incidence. The main age incidence amongst our small series was in the age group 1-14 years. In West Africa, Jelliffe(1952) found chickenpox to be commoner in the dry season, but our numbers are too small to give a reliable seasonal incidence rate.

The Swahili word for chickenpox is tetewanga, which is derived from tete, grain, and so refers to the grain-like appearance of the eruption. The Kikuyu word is muthanduku, whose derivation is unknown.

Herpes zoster(088):

The eleven patients with herpes zoster were almost all in the group 15-30 years. The two exceptions were a girl of six, and an old man of eighty-six. Three cases were ophthalmic in type. The disease is probably commoner than our figures would suggest, and is often endured at home without recourse to medical aid.

Mumps(089):

The Kikuyu name for this disease is mungai, the disease of the glands(ngai). Our figures are rendered less significant by the fact that they contain twenty cases from a small mumps epidemic in the Girls' Boarding School at Tumutumu during 1953. Apart from these cases, the others do not show any special annual or seasonal incidence. The sex and age incidence is given in Table LVI, which must also be interpreted in the light of the epidemic which explains the female preponderance especially in the age group 5-14 years. Five males developed orchitis which gives an incidence of about twenty-five per cent.. Manson-Bahr(1954) says that a third of the males who develop mumps in the tropics show orchitis.

AGE GROUP	5-14	15-24	25-34	TOTAL
MALE	6	14	1	21
FEMALE	16	12	3	31
TOTAL	22	26	4	52

Table LVI. Age and sex incidence of mumps.

Infectious hepatitis(092):

There were nineteen cases of infectious hepatitis in this series with no deaths. Only one patient gave a history of having had intravenous injections within the previous three or four months, and he might have been more correctly described as a homologous serum jaundice. It is quite possible, however, that some of the other cases may have had intramuscular or intravenous injections within the same period before the onset of their disease and which they did not remember or care to reveal.

The age and sex incidence of the disease is given in Table LVII. There is a definite preponderance of males, and most cases occurred in the age group 5-24 years. The annual and seasonal incidence of so small a series is not significant.

AGE GROUP	5-14	15-24	25-34	35-44	45-54	TOTAL
MALE	4	5	1	2	2	14
FEMALE	2	2	1	0	0	5
TOTAL	6	7	2	2	2	19

Table LVII. Age and sex incidence of infectious hepatitis.

Trachoma(095):

Trachoma is believed to have been introduced to East Africa by the Arabs and the Indians, for it was formerly very rare there(MacCallan,1934). It was not realised how widespread the infection was in East Africa until the visit of Sir Stewart Duke-Elder in 1949. His findings were summarised in the annual report of the Kenya Medical Department for 1950: "The disease was found to be most active in children, but in adults tends to be a self-limiting disease and is more often than not found to be in a quiescent stage."

Many cases were treated as outpatients, but eighty were judged severe enough to be admitted to hospital. The age and sex incidence of these cases is given in Figure 44. Males predominate, and the age group 5-24 years contains eighty-five per cent. of the cases. There were twenty-five cases of entropion which were presumably the result of old trachoma infection, and fourteen of these were operated on.


FIGURE 44: Age and sex incidence of TRACHOMA: (80 cases).
males
females.
Number of cases.
30
20
10
1-4
5-14
15-24
25-34
35-44
45-54
55-64
AGE GROUP

Tick-borne typhus(104):

Only one case was recorded in our series, in a girl of eighteen years. No Weil-Felix reaction was carried out and so the diagnosis must be regarded as doubtful for typhus is a rare disease in the African in Kenya, though not uncommon in the European. It is difficult to account for this since the African's rural environment and contact with animals should expose him as much as the European to tick bites. It may be, as Gelfand(1952) suggests, that he contracts a mild infection in childhood which is not seen in hospital. But surely some cases of this kind would be seen and recorded, but none have been.

Falciparum malaria(112):

Originally there was no malaria in the Kikuyu country. The Kikuyu called the disease the murimu wa safari, or the disease of going on a journey. In 1915 Dr Philp of Tumutumu Hospital reported a "great increase" in malaria following the long rains in an area near Tumutumu. But even as late as 1930 Gillan said that he had seen only three cases in three years whose infection had been contracted locally, whilst he saw numbers of cases among men returning from work on European farms.

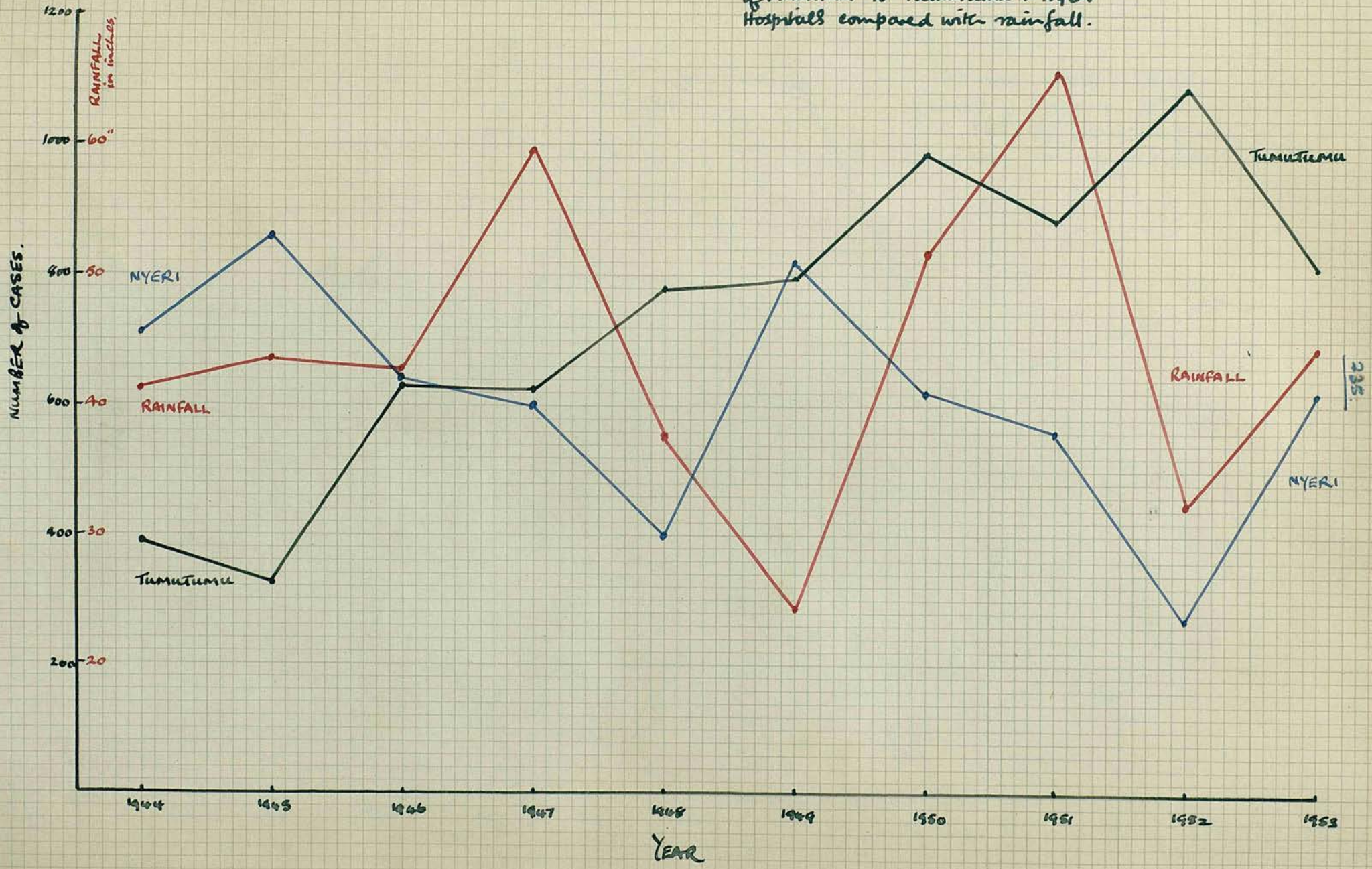
The picture which emerges from a study of malaria in South Nyeri District is an epidemic one in which the disease shows a definite seasonal incidence. The district is a hypoendemic one according to the criteria laid down in the World Health Organisation monograph on Malaria Terminology for the spleen rate in children is

very low, although no systematic survey has ever been published for the district. Cullinan(1946), who was in charge of the Army Medical Services in East Africa during the recent war, said that they regarded the Kikuyu as non-immunes in relation to malaria.

The parasite responsible is almost invariably the Plasmodium falciparum, and this was the experience of the Army all over Kenya. In most cases the infection is a mild one, though complications are not unknown as we shall see below.

The annual incidence of malaria admissions is given for both Tumutumu and Nyeri Hospitals in Figure 45 together with the mean annual rainfall. It will be seen at once that there is little relationship between the rainfall and the annual incidence of malaria. There seems to be little relation between the incidence of malaria in the two hospitals either. The admissions to Nyeri Hospital have varied from year to year and, if anything, have shown a downward trend. The cases admitted to Tumutumu Hospital, on the other hand, show a consistent and even startling rise over the ten years. The problem is to know whether this represents a real rise in incidence or not. Dr Brown, who is at present in charge of Tumutumu Hospital suspects that the laboratory assistant diagnoses malaria from a blood slide too readily and some of his observations are untrustworthy. The significant thing is, however, that these cases show the kind of seasonal incidence which we should expect to find in malaria(see Figure 46) and this would be difficult

FIGURE 45: Annual admission rate of cases of MALARIA to Tumutumu & Nyeri Hospitals compared with rainfall.



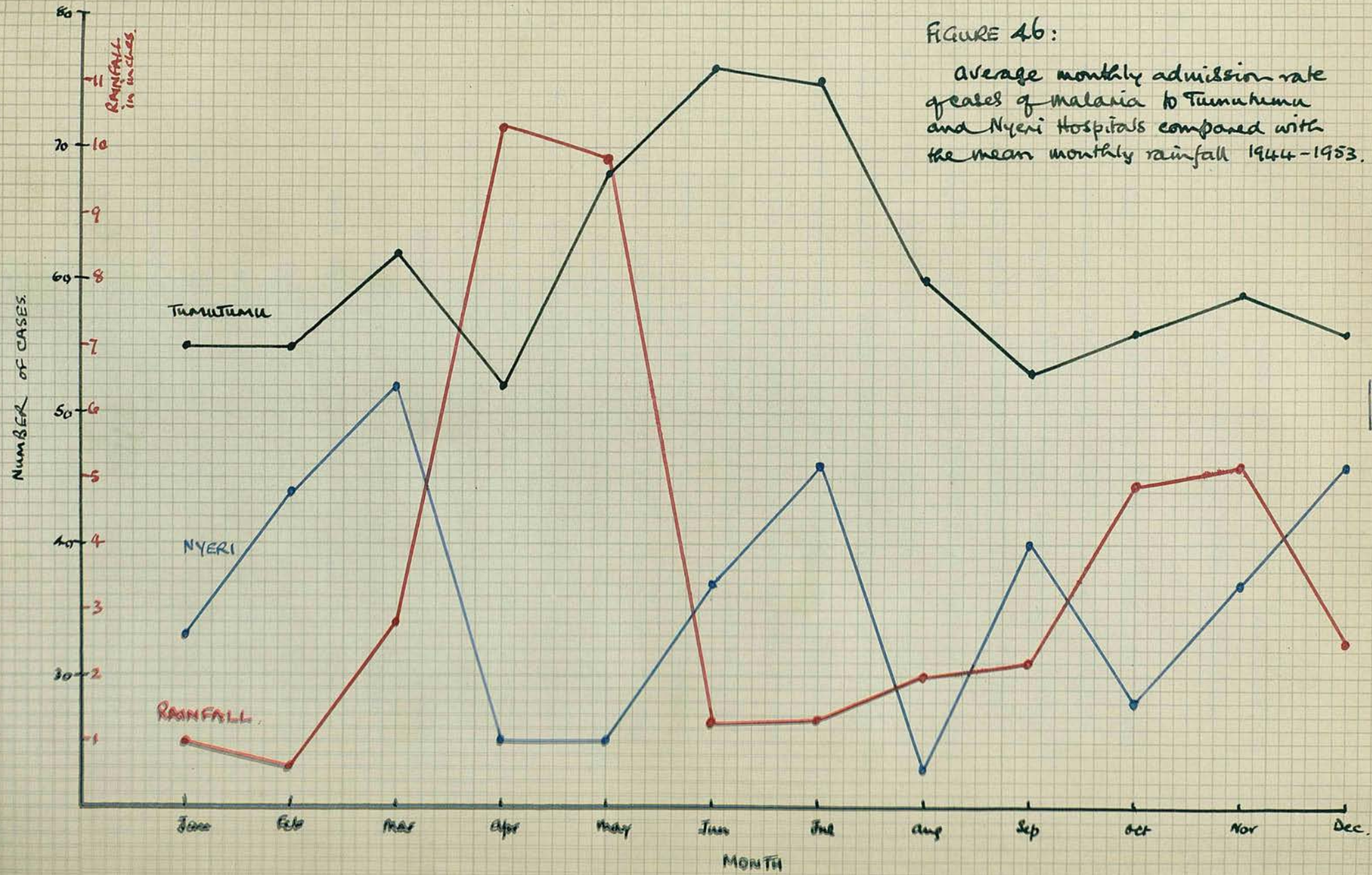


FIGURE 46:

Average monthly admission-rate of cases of malaria to Tumutumu and Nyeri Hospitals compared with the mean monthly rainfall 1944-1953.

to explain if they were not in fact cases of malaria. It appears that we shall have to accept this increase as a real one in the incidence of malaria around Tumutumu Hospital.

The average monthly admission rate of malaria cases to both Tumutumu and Nyeri Hospitals is given in Figure 46. In contrast to the annual rates, the monthly rates show a marked degree of correspondence. It should be noted that strictly speaking the Nyeri figures are those of admissions, while the Tumutumu ones are of discharges, but since malaria is a very short-term fever the difference has been neglected. Also on Figure 46 is plotted the values of the average rainfall for each month of the year. The curves of admission rates show a very significant relationship to the rainfall curve. The admission rates follow the rainfall with an interval of one to two months between. April is the first month of the year with heavy rainfall, but the admission rate does not rise until June when the rains are almost over. Also, in October the rains begin again, but the rise in admissions does not appear until December. This lag period has an obvious explanation for it is the period during which the Anopheles gambiae is breeding. Were we able to obtain figures for the counts of mosquito larvae each month, we should obtain a curve which would run between that for the rainfall and that for admissions of cases of malaria to hospital.

Figure 47 gives the age and sex incidence of the cases of malaria seen in Tumutumu Hospital. The sex incidence is roughly equal, and the bulk of the infections occur

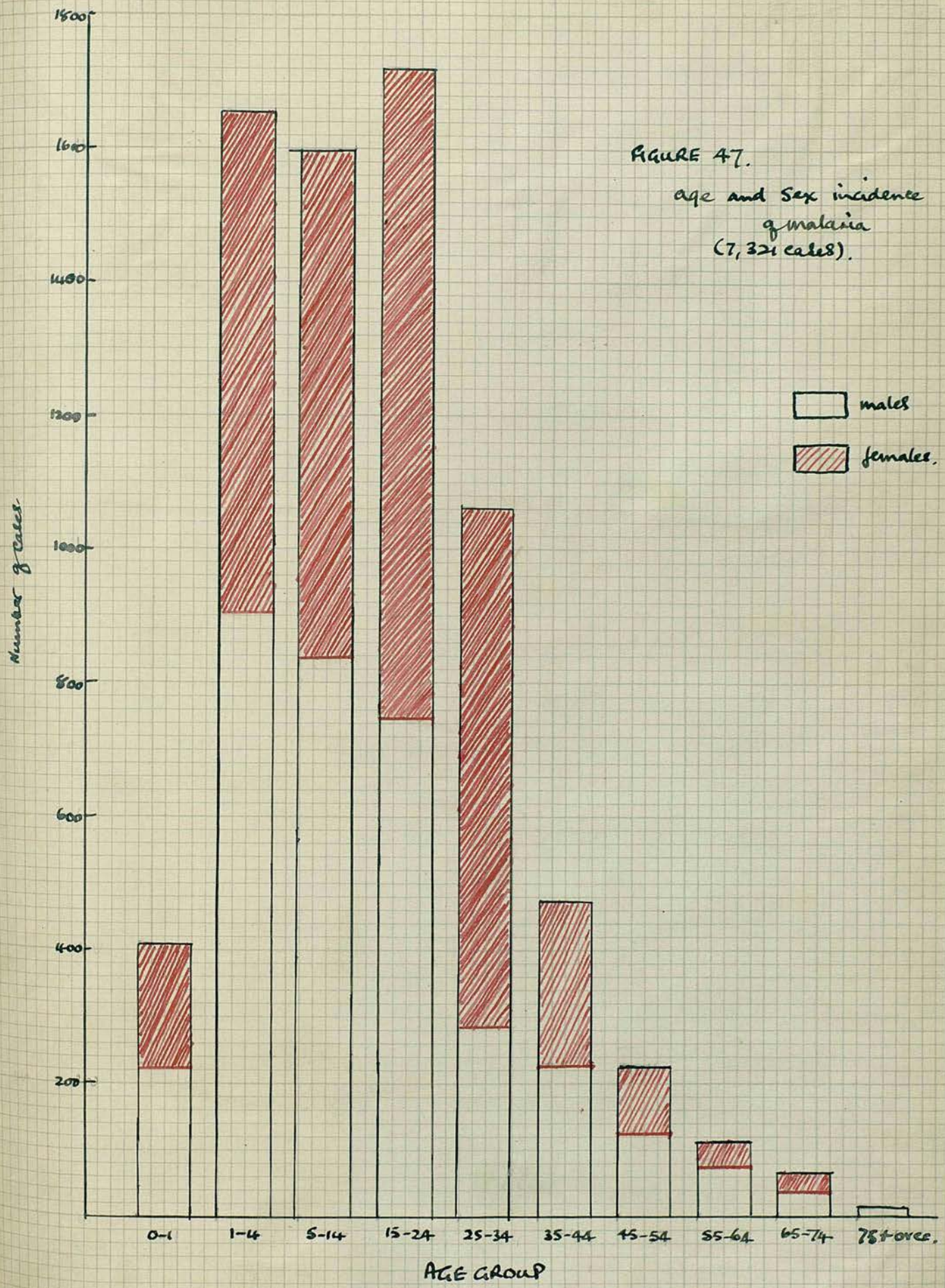


FIGURE 47.

age and sex incidence of malaria (7,321 cases).

in the age group 1-34.

Seven deaths were recorded as due to uncomplicated malaria. They may have been so caused, but the usual infection is so mild that it is possible that the real cause of death may, in fact, have been some other disease.

The complications of falciparum malaria which were seen in this series were as follows:

Cerebral malaria	37 cases	18 deaths
Malarial psychosis	21 cases	no deaths
Blackwater fever	5 cases	2 deaths

Cerebral malaria is not very common in the African. Gelfand(1947a) found only 0.45 per cent. of two thousand autopsies to show signs of it, and our series shows an incidence of only 0.5 per cent.. When it occurs, however, it is a serious complication with a mortality of about fifty per cent.. The age and sex incidence and mortality are given in Figure 48. Females predominate and the commonest age group is the 15-34 years. It should be remembered that the diagnosis in these cases was entirely clinical, and it is possible that some of these cases were in fact suffering from other types of encephalitis than malarial.

Of the twenty-one cases of malarial psychosis, sixteen were females, and nineteen were in the 15-34 years age group. Some of these cases had been given mepacrine and it is difficult to be certain which may have been cases of mepacrine psychosis rather than malarial.

FIGURE 48: age and sex incidence and mortality of cerebral malaria: (37 cases).

Blackwater fever(115):

Blackwater fever was first reported in Africans in the year 1920 in East Africa(Kenya Medical Department,1920). There were five cases in Africans in our series. All were males; two were from the same family, the father aged forty-six years and a son aged four. The father died and so did another patient aged thirty-six. None of these patients had taken anti-malarial drugs before admission.

General notes on helminth infestation:

The widespread incidence of helminth infestation amongst the African peoples was first realised during the first world war from the work of Shircore and others in East Africa(Kenya Medical Department,1918). Such an infestation is the price man has paid for his residence in the tropics and his ignorance of sanitation.

The true incidence of such infestation is difficult to assess. Most stool examinations are done once only and no concentration method is used as a routine, therefore our results are based on single examinations of stools in most cases, and are therefore too low to give an accurate picture of the infestation rate. In seven years at Nyeri Hospital 18,656 stools were examined, and 2,926 or 15.6 per cent. of them contained evidence of helminth infestation.

The relative incidence of the different species of worms is set out in Table LVIII. This is derived from a series of 4,786 stools examined at Tumutumu and Nyeri Hospitals. There was a close correspondence between the

results obtained from both hospitals and so only the mean percentage rate is given.

SPECIES	PERCENTAGE INCIDENCE
Ascaris lumbricoides	56.2
Taenia saginata	29.7
Necator americanus	9.5
Trichuris trichiura	1.8
Schistosoma mansoni	1.5
Oxyuris vermicularis	0.7
Hymenolepis nana	0.5
Strongyloides stercoralis	0.1
Total	100.0

Table LVIII. Comparative incidence of helminth infestations in South Nyeri District.

It is obvious from the table that the bulk of the helminth infestations are due to the round-worm and the beef tapeworm.

Schistosomiasis(123):

Schistosomiasis is not common in the district and in most cases may have been contracted outside of the district. Our nine cases were of infection with Schistosoma mansoni, and eight of them were males. Schistosoma haematobium was found in twenty-seven cases in seven years at Nyeri Hospital, but was not diagnosed

in any case at Tumutumu. There is no reason why it should not occur since the vector snail, Bulinus tropicus, has been identified in the Ragati river which runs through the area about five miles from Tumutumu(Health Officer,1943).

Taeniasis(126):

The beef tapeworm, Taenia saginata, is the usual species seen in South Nyeri District. The Kikuyu are quite familiar with the worm and its segments, and will often come to hospital saying that they have seen the segments in their stool. They call the worm ndanguru, which is said to be derived from the combination nda, the abdomen, and nguru which is the adjective "bad". In olden times they believed that it was the result of drinking fresh milk(Barlow,1924), a belief which may have been suggested by the milky-white appearance of the segments of the worm.

The source of infection is, of course, beef, and Ginsburg(1954) has found 21.7 per cent. of cattle to be infected with the Cysticercus bovis in Kenya. Many workers believe that the hump of the Zebu cattle is the site of predilection for the infection, but he found it was commonest in the shoulder muscles and the masseters.

Since it is the custom to admit patients to hospital with tapeworm because of the necessity of control of treatment, the incidence figures for Tumutumu are quite representative of the numbers of cases seen. The annual incidence is shown in Figure 49, and there does appear to be a decline in the number of cases seen over the decade.

The seasonal incidence of tapeworm has little meaning since it is a chronic infestation often only discovered accidentally. The sex incidence(see Figure 50) is very interesting. It was the custom in former times to give the meat to the men, and the women ate meat only on very rare occasions. It is an interesting comment of the passing away of this custom, that twenty-seven per cent. of the tapeworm infestations were in females. This confirms what we have already noted in commenting on intestinal anthrax above. The age incidence is also given in Figure 50, and it is maximum in the 15-24 years group. Sixty-six per cent. of the infections occur in the age group 5-34 years.

Pigs have been kept by the Kikuyu for a number of years now, and are being increasingly invested in since the new concentration of the people in large villages. They are not used for food, but are sold to the bacon manufacturers. However, taeniasis solium does occur for Carter(1953) described a case of cysticercosis cellulosae in a Kikuyu girl from Fort Hall District. No cases were,however, diagnosed in Tumutumu or Nyeri Hospitals in the period under review.

Taenia echinococcus has been seen in cattle slaughtered for food at Nyeri(Health Officer,1949), but no cases of hydatid cysts in human beings have been recognised so far.

At Fort Hall Hospital two tumours were excised from two Kikuyu children in 1946, and on examination they were found to contain a coenurus of Multiceps serialis. No

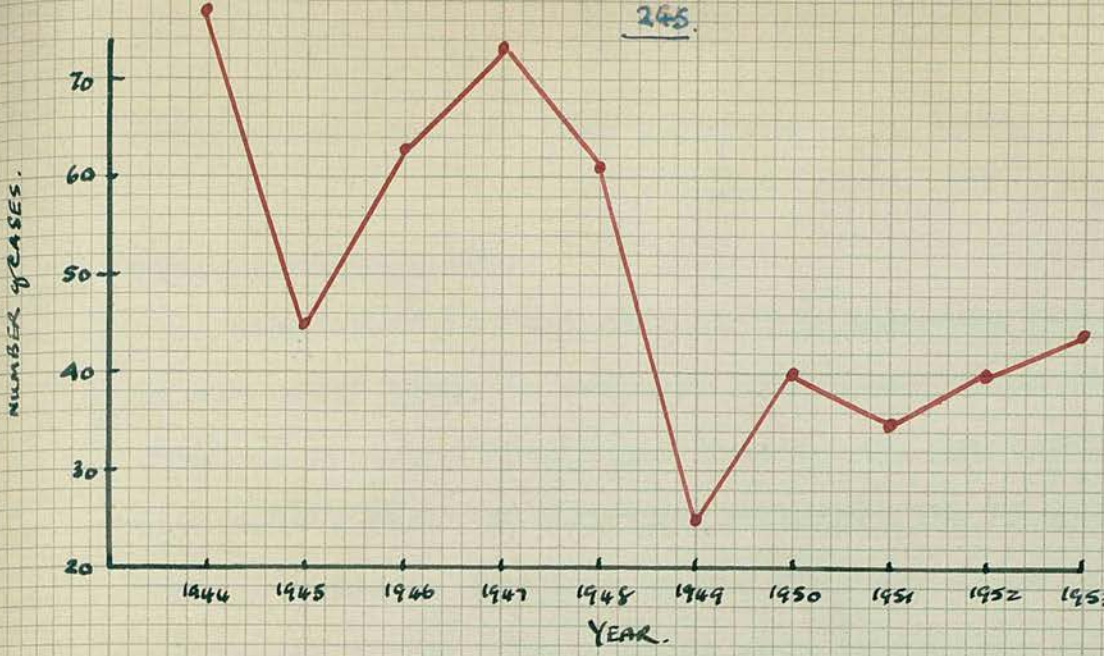


FIGURE 49. Annual incidence of tapeworm infestation in Tumutumu Hospital inpatients.

FIGURE 50. Age and Sex incidence of tapeworm infestation in Tumutumu Hospital inpatients. (503 cases)

similar case has yet been encountered in South Nyeri.

Ankylostomiasis(129):

Kikuyuland is fortunate in that hookworm infestation is not heavy there as compared with other parts of tropical Africa. This means that we are not troubled with severe cases of hookworm anaemia. The Kikuyu name for the worms is the same as the English, since it means the hooked worms. The species seen is usually the Necator americanus. The annual incidence of the cases of infestation shown in Figure 51 shows a very definite decline over the decade and this suggests that the influence of health education and propaganda is now appearing. Figure 52 gives the age and sex incidence of hookworm infestation. Males show a marked preponderance over the females, and the age group mainly affected is the 15-24 years group.

Ascariasis(130):

This is by far the commonest worm infestation amongst the Northern Kikuyu and it reflects the low level of personal hygiene which still prevails amongst them. Their name for the roundworm is njoka ndune, the red worm. It would be of great interest to know how many of the atypical pneumonias we see are really cases of "ascaris pneumonia". As in the cases of tapeworm and hookworm, round-worm infestation shows a decline over the decade which if real can only be explained by the influence of health education in school and dispensary. Males are more affected than females as shown by Figure 54, and

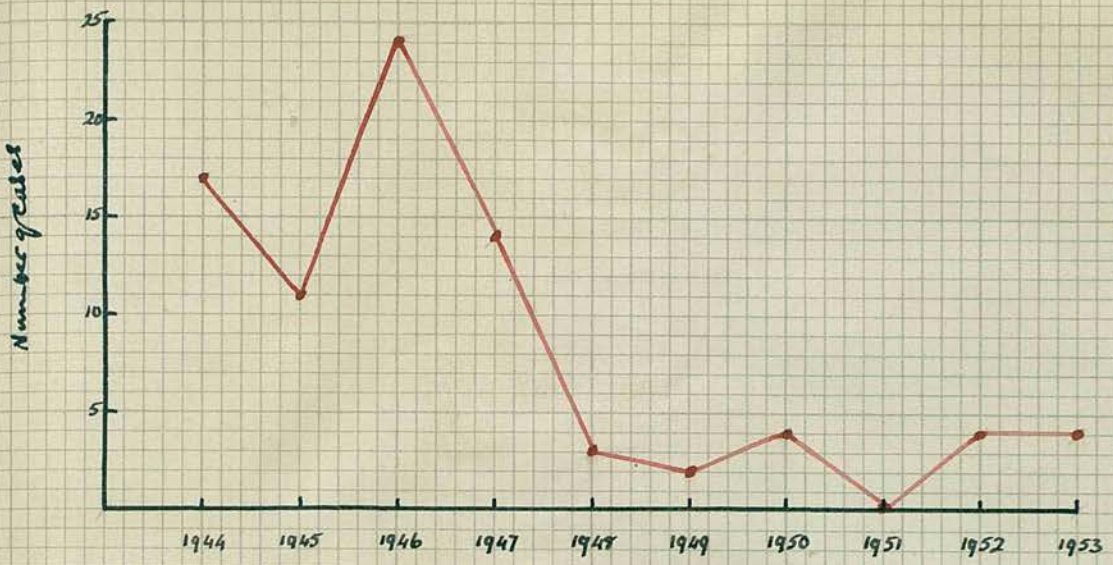


FIGURE 51: The annual incidence of hookworm.

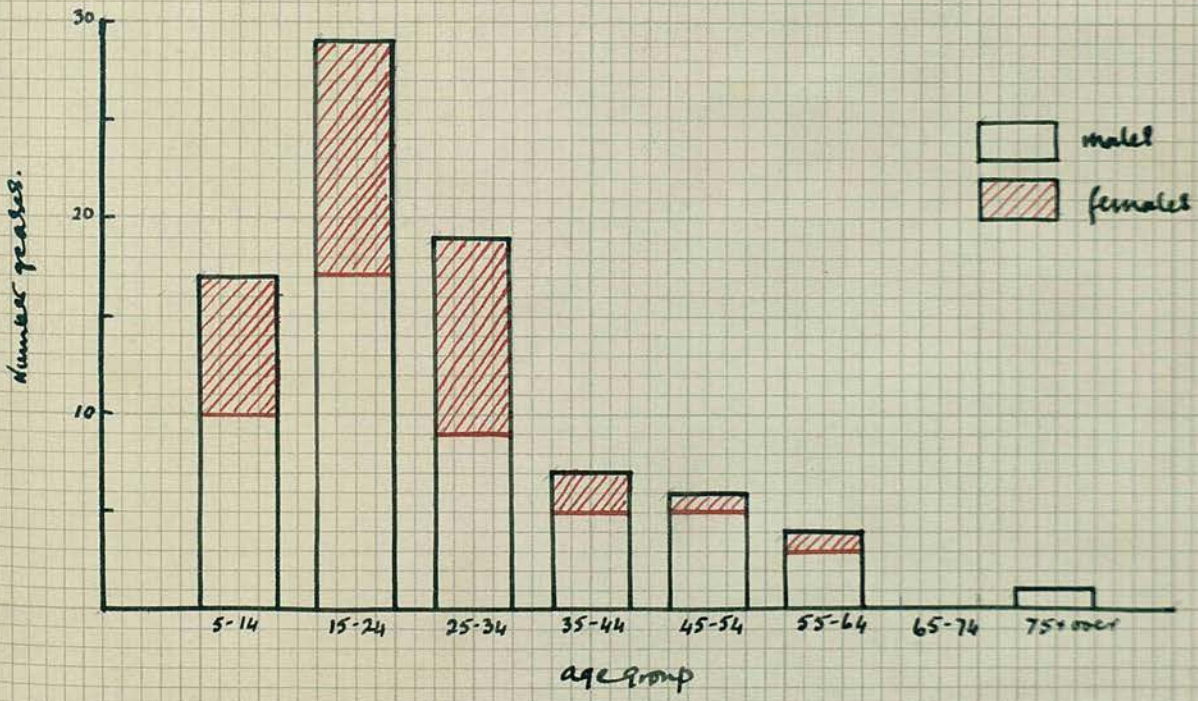


FIGURE 52: Age and Sex incidence of hookworm.
(83 cases).

FIGURE 53:
Annual incidence of roundworm infestation.

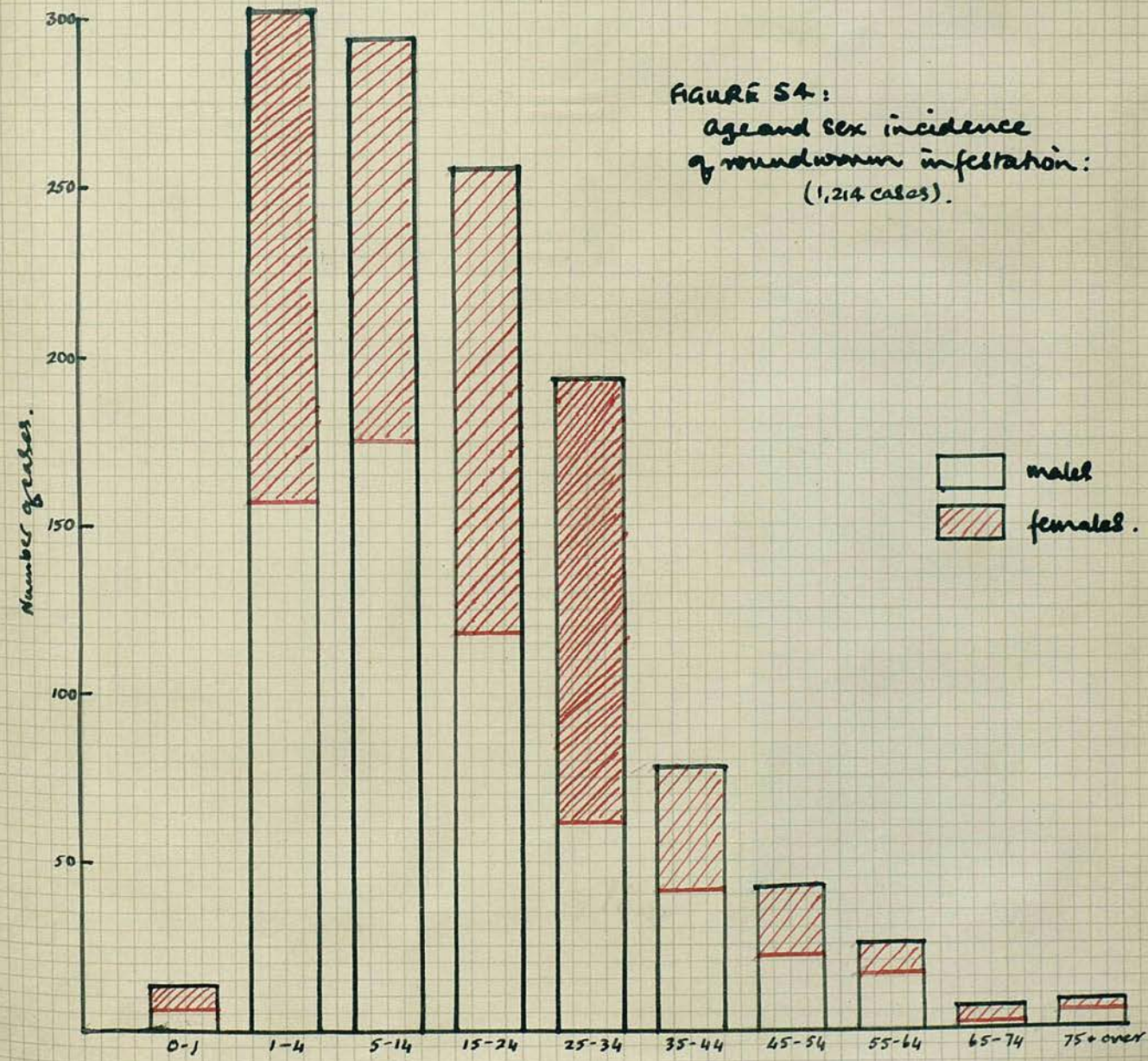


FIGURE 54:
Age and sex incidence of roundworm infestation:
(1,214 cases).

sixty-nine per cent. of the cases occurred in the age group 1-24 years. The largest number of cases is seen in the age group 1-4 years, followed very closely by the 5-14 years group. Thus roundworm infestation occurs earlier in life than hookworm and tapeworm. This is shown by the curves in Figure 55.

No cases of complications due to roundworms are included in our series, but such complications do occur. An occasional case of intestinal obstruction is due to the impaction of a mass of worms in the lumen of the bowel, and there is no doubt that "ascaris pneumonia" is a real entity. It is possible too that some of the cases of urticaria may be due to sensitisation to the toxic products of the roundworm.

There is little needed by way of comment on the other worm infestations. They were not common and not very important in the production of symptoms. At Tumutumu Hospital in ten years there were thirty-three cases of infestation with Trichuris trichiura, fourteen with Oxyuris vermicularis, three with Hymenolepis nana, and one with Stronglyoides stercoralis.

Miscellaneous infective & parasitic diseases:

Fungus infections are not common. Moniliasis(134) occurs mainly as thrush in the mouths of young infants. The two cases of Madura foot were in males, both of whom were about thirty years of age. In both cases the foot had to be amputated.

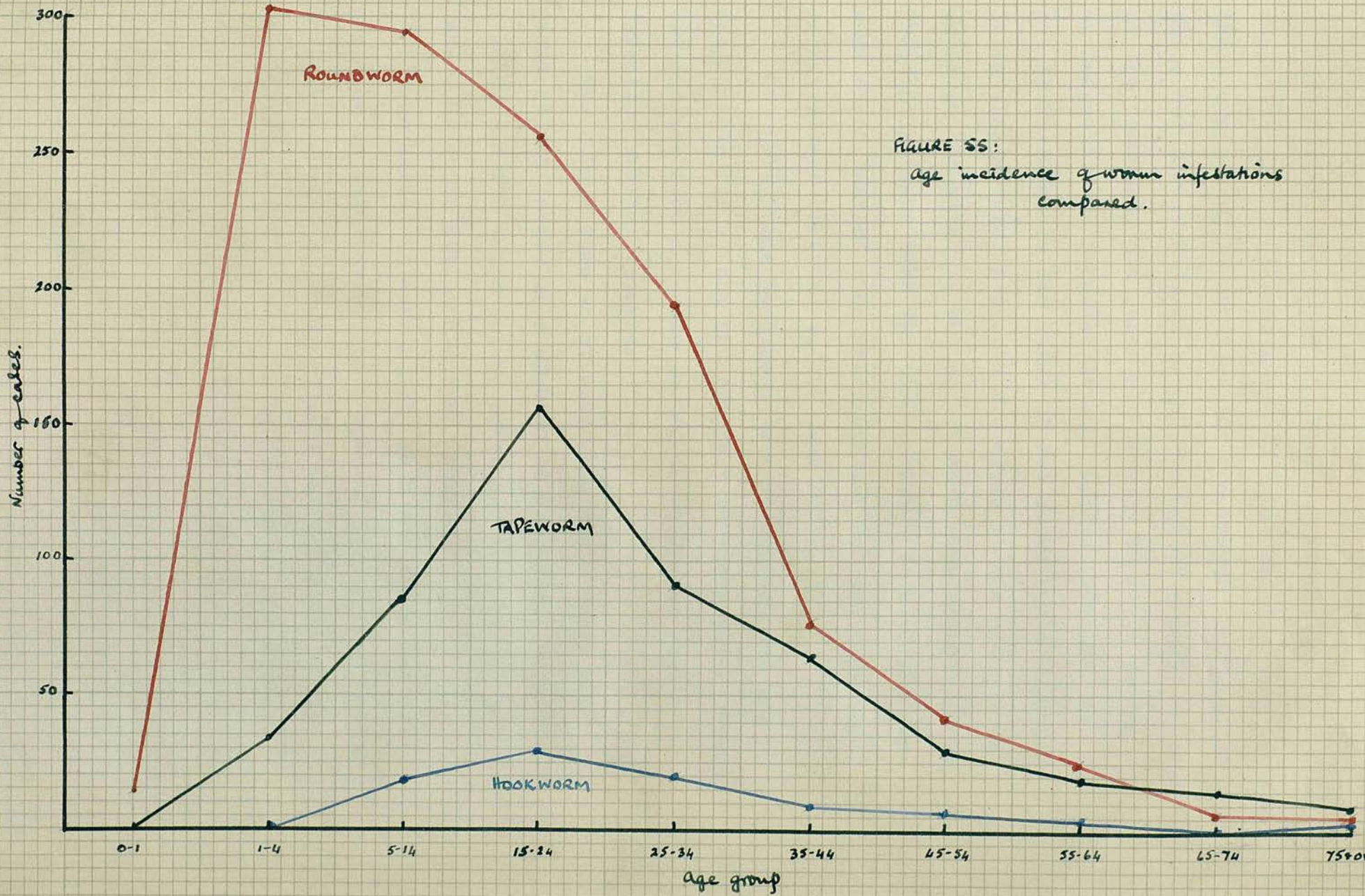


FIGURE 55:
age incidence of worm infestations compared.

250.

Parasitic infections are much commoner than is suggested by the figures given in Table XLI for many of these cases are not admitted for treatment. Scabies(135) while not widespread, is spread throughout a small section of the community and cases can usually be found during an inspection of schoolchildren. Pediculosis(136) is not as uncommon as our total of two cases would suggest. It is mostly seen in people who dress in the old way in skins or blankets and who do not wash very often. It is frequently found when they are admitted to hospital for some other disease and, unfortunately for our figures, is not always recorded in the case notes.

Chiggers(Tunga penetrans) are widespread and are responsible for a form of crab gait in young boys. Their burrows are also a common portal of entry for septic infection and for tetanus.

The single case of myiasis(138) was a youth who produced the larvae of a species of Sarcophaga from his stools, and who would not be convinced that he did not have some worms eating him away inside.

Ainhum(138) is very rarely seen and there was only one case in this series, in a male of twenty-four years. This lesion must be regarded as a manifestation of the fibroplasia which appears to be the lot of the African people, and which is also illustrated by their great tendency to keloid formation.

II. NEOPLASMS:

The incidence of neoplasms in Africans is still not well-known. Most of our knowledge is derived from post-mortem material published from the various medical centres in Africa, including Nairobi and Kampala in East Africa. In 1951, the faculty of medicine of Makerere College in Kampala set up a committee to organise a cancer survey in Kampala, and when this is complete it should throw a great deal of light on the incidence of cancer in East Africa(Croot and Davies,1952). Meantime it is possible to piece together some kind of a picture of the type and incidence of neoplasms in the African.

There are certain factors which influence such a picture and they must be mentioned at the outset of our discussion:

1. The age structure of the population:

In our study of the population in an earlier section we saw that there was a decreased number of people in the older age groups in Africa, compared with the numbers in Britain and other countries. Therefore, in Africa, many of the population die before they reach the age at which they might suffer from a neoplastic lesion. Not many of them reach the age of sixty-five years, and in Europeans half the total number of deaths due to cancer occur over that age(Davies,1949a).

2. The skin pigmentation of the African:

The increase of pigment in the skin of the African which presumably was the result of climatic conditions, leads to a relative increase in the number of melanomata

when compared with the white race.

3. Malnutrition:

Protein malnutrition appears to be a fundamental factor in the production of the carcinoma of the liver which is so common in the African.

4. The common incidence of tropical ulcer:

The occurrence of tropical ulcer in Africans means an increased risk of malignant degeneration of part of the ulcer with the production of a squamous epithelioma.

5. The practice of male circumcision:

The widespread tribal practice of ritual male circumcision may explain the rarity of malignant growths of the penis amongst the Kikuyu.

6. The influence of liver disease:

The liver, when damaged as the result of protein malnutrition is believed by Davies(1949b) to be unable to inactivate the oestrogens which, since they are potential carcinogenic agents, may play a part in the production of neoplasms, especially perhaps, neoplasms of the liver.

It is not possible to estimate the total incidence of neoplasms in the African population for many cases never seek medical aid. Manson-Bahr(1954) suggests that the incidence of cancer amongst primitive races is much the same as amongst civilised peoples, but we do not yet have sufficient data to prove or disprove his statement. In our series we saw three malignant tumours for every two benign ones, but since patients are much more likely to seek medical aid for malignant tumours

than for benign ones, this ratio has little meaning.

All authors who write on malignant disease in the African comment on the high proportion of non-epithelial growths to epithelial in comparison with that seen in European practice. Thus Piers(1948) gives the following prpportions from Kenya medical practice:

TUMOUR	KENYA AFRICAN	KENYA EUROPEAN
Sarcoma	1	1
Carcinoma	1.5	9.6

This difference is said to be due to the fact that a greater number of reticulo-endothelial tumours are seen in the African than in the European(Croot & Davies,1952).

With regard to the type of malignant neoplasms which occur in the Kikuyu, it is possible to construct a table to show the common and rare types. The following two lists are based on our own cases and on those published by Clark(1948) from Fort Hall.

COMMON	RARE
Carcinoma of the liver	Rodent ulcer
Squamous epithelioma	Carcinoma of tongue
Lymphosarcoma	Carcinoma of stomach
Carcinoma of uterine cervix	Carcinoma of bowel
Malignant melanoma	Carcinoma of bladder
Kaposi's sarcoma	Carcinoma of prostate
Carcinoma of female breast	

Unfortunately, not all of the malignant tumours in our series were identified histologically, and so in some cases it is impossible to certain of their origin and nature. This is particularly true of the tumours of the nose, mouth, pharynx and larynx, about which little more than their position can be specified.

The two tumours of the oesophagus were carcinomata. One was diagnosed clinically and at post-mortem, and the other by x-ray examination. The carcinoma of the large intestine was a mucoid carcinoma of the caecum in a woman of twenty-eight which seeded itself all over the peritoneal cavity and finally caused her death. Croot and Davies(1952) writing from Kampala say that "carcinoma and other tumours of the small intestine appear to be unduly common" there, but this is not our experience in Kikuyuland.

In the Tumutumu series, carcinoma of the liver was the commonest malignant tumour diagnosed. It must be admitted however that the diagnosis was sometimes purely clinical. Much has been written on the subject of liver carcinoma in the African, but it is generally agreed that its pathogenesis is related to protein malnutrition which damages the liver and begins the process of fibrosis which may later cause neoplastic growth or provide suitable soil for such growth. The liver may also be unable to render toxic chemical agents harmless because of its damaged state and these may play some part in the production of a malignant tumour. Davies(1949b) has suggested that the oestrogens might be one of the

toxic agents responsible. Certainly it appears to be quite definite now that the evidence increasingly emphasises the importance of environmental factors in the pathogenesis of primary liver carcinoma in man (Lancet editorial,1951). It appeared at one time that the controlling factor in incidence might be racial (Berman,1940), but the discovery that there is a difference in incidence between members of the same race who live in different places has cast doubt on this. Berman(1951) has produced evidence to show that primary liver carcinoma is six times more common in Bantu who live in Portuguese East Africa than it is in the South African Bantu. Thus local rather than genetic factors appear to be at work, and of these probably the most important is protein malnutrition.

The nature of the liver carcinoma is of two types. It may be a true hepatoma growing from the liver cells, or it may be a cholangioma arising from the epithelium of the biliary system(Davies,1952). In our small series of twenty-three cases, fourteen were males and nine were females. Apart from one youth of seventeen, the ages of the patients ranged from thirty-two to seventy-two. There were eight deaths in this series, four of each sex.

No case of lung tumour was diagnosed in this series but it should be noted that cancer of the lung has been described recently in Uganda Africans by Raper, Elmes and Musoke(1952).

The breast carcinomata were all in the female breast. The age of the patients ranged from twenty-five to seventy-eight years. Three patients died from this disease. Carcinoma is said to be not uncommon in the male breast in the African, and Davies(1949a) gives it as responsible for twenty per cent. of all breast carcinomata in Kenya. But there is no case in this series.

Carcinoma of the cervix of the uterus is much more common than that of the body. In this series it was ten cases to one, but a more accurate ratio is probably that of four to one for a larger series at Kampala(Mulago clinical meeting,1951).

In most series squamous epithelioma of the skin is the commonest malignant tumour, e.g. Clark(1948) and Davies(1949a). Almost invariably this is an ulcer-cancer or a cancer arising in a pre-existing tropical ulcer situated on the leg. It was commoner in the male than in the female in our series and the one exception to the usual location on the foot was a male of twenty-nine who came with the tumour on his right index finger not arising from an ulcer. The ages of our thirteen patients ranged from twenty-five years to sixty. One died from this condition.

Kaposi's sarcoma is seen from time to time in the Kikuyu, and appears to be commoner in the African than in the European. Clark(1948) saw two cases in his series of fifty malignant growths, and our series contains one. Our case occurred in a male of forty years and affected both hands and both feet, but had begun in his right hand.

The patient with Hodgkin's disease(201) was a male of twenty-five years who died from the disease and was diagnosed from the histological appearance of post-mortem material taken from the glands of the neck. The other two reticuloses were also in males and were diagnosed histologically from biopsies. One of these patients died. The two fatal cases of leukaemia(204) were of different types; one was an acute monocytic leukaemia in a boy of six years, and the other was an acute lymphatic leukaemia in a boy of one year. It is probable that there are cases of chronic leukaemia living in the district undiagnosed for in 1954 a woman aged about forty years came into hospital complaining of tiredness and was found to have a chronic myelocytic leukaemia. It is of interest to record that the first case of myelocytic leukaemia to be described in a Kikuyu was described from Tumutumu by Gillan(1929) in a male aged twenty-two years.

The benign neoplasms form a miscellaneous lot. There were two patients with an epulis(210). One with a neuroma of an amputation stump, a male of fifty-two years. The two cases of von Recklinghausen's disease were a male of fifty years and a female of twenty-four. The skin melanomata were in eleven patients, ten males and one female, with an age range of from fourteen to seventy-five. The fibromata occurred in three males and nine females. In four of the females it occurred over the greater trochanter of the femur, and in three more over the lumbar region where it has been called the

"Kikuyu bursa". This forms over the lumbar spine as the result of the Kikuyu method of load carrying in which the major weight of the load is carried on the lower part of the back without any attempt to pad it and so protect the skin. One dermoid cyst(227) was situated at the upper end of the sternum in a boy of four, the other two were in the region of the temple in males of six months and ten years. The other benign tumours(229) were three lipomata and two keloids.

III. ALLERGIC, ENDOCRINE, METABOLIC & NUTRITIONAL DISEASES:

Allergic diseases:

The two commonest allergic diseases seen amongst the Kikuyu are bronchial asthma and urticaria.

Bronchial asthma is not uncommon and 151 cases were severe enough to warrant admission to hospital in our series in ten years. The annual incidence of bronchial asthma appears to bear a definite relation to the average annual rainfall in Figure 56, though the discharge rate for each month shows no relation to the average monthly rainfall in Figure 57 unless it be an inverse one. The latter phenomenon is hard to explain since we do not usually keep our cases of asthma in longer than a fortnight. The age and sex incidence of bronchial asthma is given in Figure 58. There is a definite preponderance of males and almost seventy per cent. of the cases occur in the age group 15-34 years.

FIGURE 56 : Annual incidence of bronchial asthma compared with the mean annual rainfall in Tumutumu area.

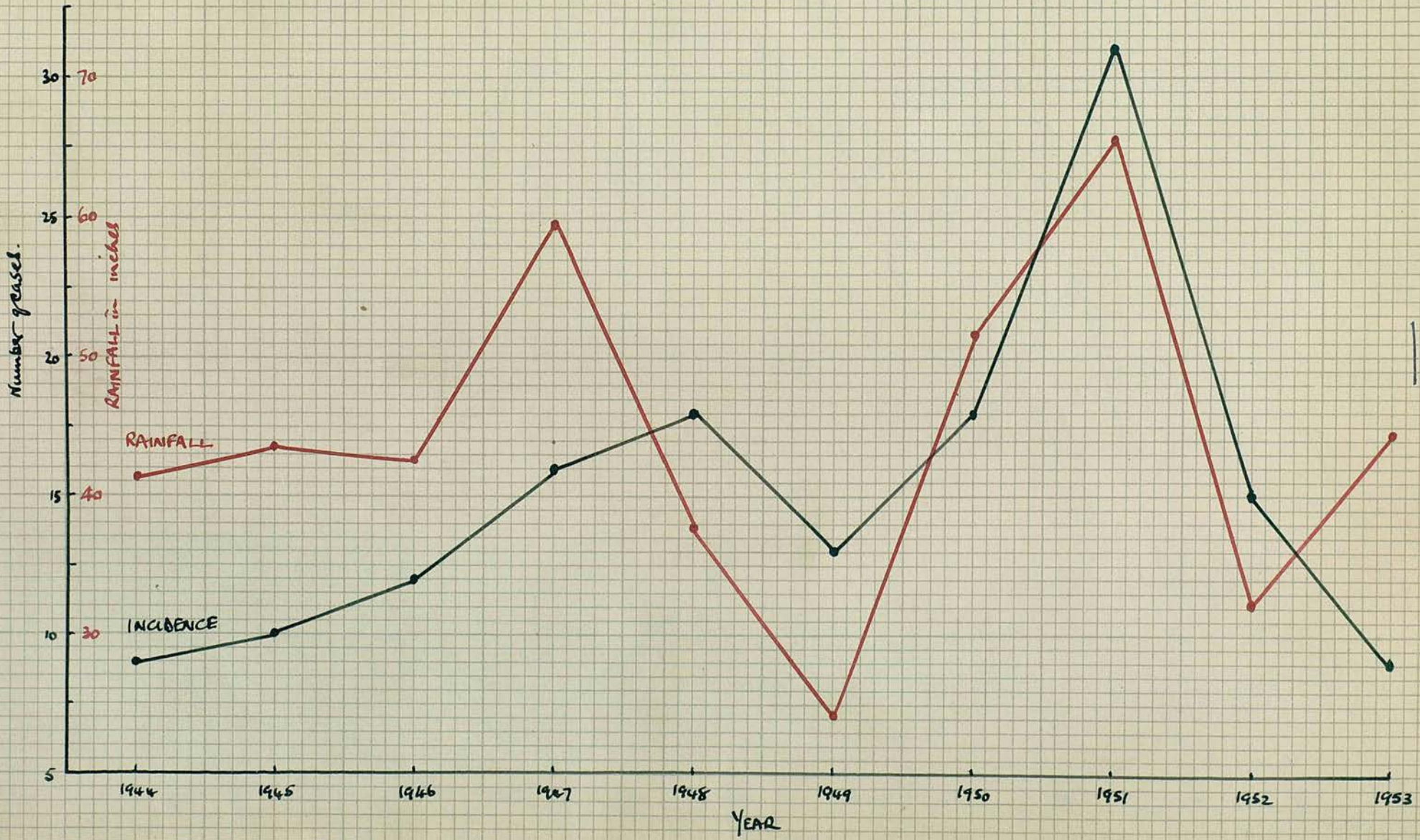


FIGURE 57: Monthly incidence of bronchial asthma compared with the mean monthly rainfall in Tumutumu area.

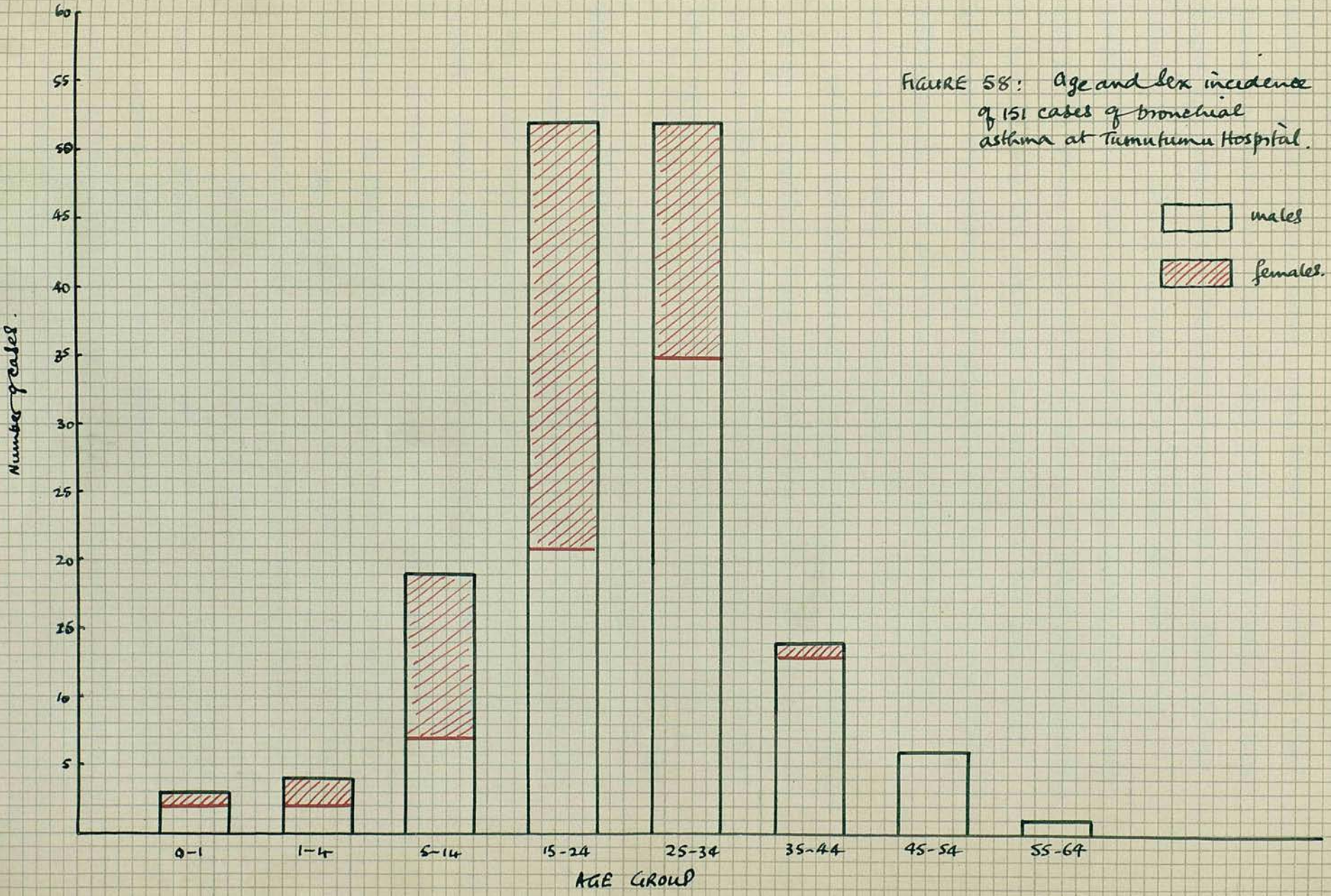


FIGURE 58: Age and sex incidence of 151 cases of bronchial asthma at Tumutumu Hospital.

Urticaria is not uncommon in outpatients and 119 cases were seen in three years. Many more cases occurred than these probably, but they did not seek medical aid. Thirty-eight patients were admitted to hospital, of whom thirty were males. The peak incidence was in the age group 15-24 years. The nine cases of angioneurotic oedema were all males whose ages ranged from ten to sixty-eight years. In most cases the cause of the urticaria was not found as there are innumerable possible allergens in the African environment. In one case the urticaria followed the intravenous infusion of dextran.

Of the seven cases of allergic eczema, four were males and three females. One of the males aged fifteen may have got his eczema after exposure to cement dust, and another male aged forty from exposure to diesel oil.

Endocrine diseases:

Endocrine disorders are rare in the African, and the only gland represented in our series is the thyroid gland. There are no disorders of the pituitary, the parathyroids, the adrenal or the sex glands in this series. In 1954 we had a patient with what appeared to be a diabetes insipidus. She was about fifty years old and was passing about thirteen pints of urine daily which was reduced by the injection of posterior pituitary extract. Apart from this case I have never seen any of the pituitary syndromes in a Kikuyu patient. Davies(1946) mentions that in Uganda an occasional case of acromegaly is seen in an African, and in the same

article he describes a case of diabetes insipidus and obesity in a leper girl aged eight years.

The case of simple goitre(250) occurred in a girl of fifteen was probably was physiological in type. The nontoxic nodular goitres(251) were seen in five females and one male whose ages ranged from twenty-five to seventy-two years. The two cases of thyrotoxicosis were mild and one occurred in each sex, a male aged sixteen and a female aged forty years. The first case of thyrotoxicosis to be described in Kenya was in a Meru tribesman aged forty(Howell,1928). He had an irregular pulse and so may have shown auricular fibrillation too. The disease is very rare, however, and Carothers(1940) saw only one case in ten years' work in Kenya. Anderson(1939) after an extensive experience in Kenya, said he had never seen a case in an African and only one in an Asian, whilst the incidence in Europeans appeared to be slightly higher in Kenya than it was in England. Davies suggested that the reason for its rarity could be explained on his theory of oestrinisation of the African body due to liver failure secondary to protein malnutrition for it is a well known fact that oestrogens inhibit the thyroid gland (Davies,1949b).

Diabetes mellitus(260):

Manson-Bahr(1954) states that "it has long been believed that true diabetes is very common in all parts of the tropics", but this is not borne out by the

occurrence of only five cases in ten years in Tumutumu area. The first case of glycosuria recorded in a Kikuyu was in Chief Muriranja of the Fort Hall District (Procter,1926a). Since that time other cases have been recorded from time to time. In 1951 Harvey, Titman and Pearson published a survey of diabetes mellitus in Kenya. They found that the disease was much the same in incidence and natural history in Europeans and Asians in Kenya, but only a few cases were seen in Africans. They linked this fact with the finding of Himsworth(1935) that a high carbohydrate and low fat diet was usually associated with a low incidence of diabetes mellitus. They gave the following rates of incidence for cases of diabetes mellitus in the three communities:

European: 140 cases per 100,000 of population,
Asian: 190 cases per 100,000 of population,
African: 5 cases per 100,000 of population.

The incidence in Africans may in fact be lower since these figures were based on the annual returns from hospitals and dispensaries where the diagnosis is often made by an African hospital assistant, and is not always reliable. Also it must be remembered in the interpretation of blood sugar curves in the Kikuyu, that he tends to show the lag type of curve in common with most vegetarians(Orr and Gilks,1931).

All the five cases were males. It was only in 1955 that I saw a female diabetic for the first time. In three cases, aged thirty, fifty and fifty-eight years

respectively, the disease was mild and was readily controlled by dietetic means alone. This was fortunate for it is not easy to ensure a satisfactory injection technique in an African hut, and the cost of the insulin may well be prohibitive for the average African peasant. The other two cases were fatal and presumably were the result of diabetic coma, though the notes did not specify this. One was aged twenty-two years, and the other forty-five. The latter patient developed a typical diabetic neuropathy before he died.

Nutritional diseases:

Nutrition is a large and important subject in Africa. The prevalence of subnutrition and malnutrition amongst the peoples of Africa is now well-recognised, and the Kikuyu are no exception. In 1955 I carried out a nutrition survey in the southern part of Kiambu District and examined 4,709 children under the age of twelve years and classified their nutritional state as follows:

Good	0.2 per cent.
Fair	85.6 per cent.
Poor	14.1 per cent.
Starving	0.1 per cent.

It should be remembered that this result was obtained under the special conditions of the state of emergency when food shortages were more acute than normally, and therefore reflects a worse nutritional state than would normally be found. Nevertheless it would be true to

say that under more normal conditions, the bulk of the population would still be found in the category of fair nutrition rather than good.

It is of interest to note that the specific states of deficiency are very rarely seen. Scurvy and rickets do not occur in the present series, whilst beriberi and pellagra are represented by very few cases indeed. The great nutritional syndrome seen in the Kikuyu is that of kwashiorkor, and to that we now turn.

Kwashiorkor(286):

Tumutumu Hospital has a special place in the early history of kwashiorkor(Trowell,Davies and Dean,1954). It is probable that Philp described a case of this syndrome in an article on ascariasis written in 1924. If this is so, then he preceded by three years the first clear reference to the disease by Procter(1927). In 1934 Gillan writing from Tumutumu gave the first full clinical description of the disease in East Africa when he described twelve cases(including three in adults) which he had collected over a period of two to three years. Finally in 1935, Dr Brown took clinical photographs of the skin of children suffering from kwashiorkor for Trowell to take home to show Stannus for his opinion on the relationship of the disease to pellagra. The later history of the elucidation of the nature of the disease need not detain us here. The disease is now regarded as the result of chronic protein malnutrition which produces a fatty change in the liver and possibly changes in other organs such as the pancreas and salivary glands,

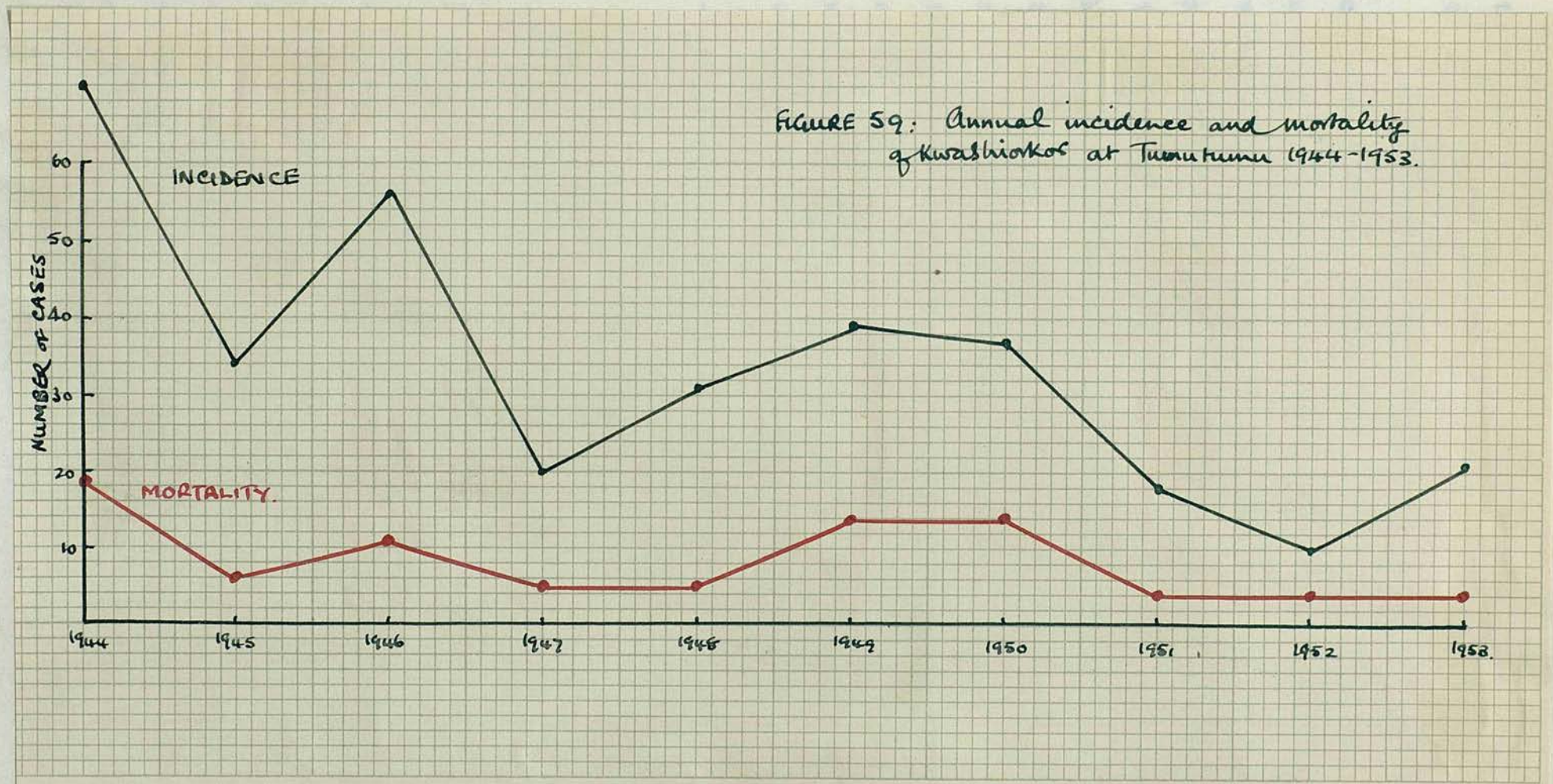


FIGURE 59: Annual incidence and mortality of kwashiorkor at Tununtunnu 1944-1953.

to which may be added various avitaminoses particularly of the B group of vitamins.

The Kikuyu had no name for the disease. The early cases were simply called the "white babies" by the medical officers at Tumutumu who first saw them. There were 331 cases admitted to Tumutumu Hospital in the ten years of this review, and 105 were seen as outpatients in the three year 1951 to 1953. The annual incidence of kwashiorkor in inpatient discharges is given in Figure 59. It shows a definite decline over the decade, and is not related to the rainfall data. The seasonal incidence is given in Table LIX and is seen to be greatest in the short dry season, in those months before the long rains when the previous harvest from the short rains, which are often inadequate is giving out. The incidence of mortality

SEASON	SHORT DRY	LONG WET	LONG DRY	SHORT WET
NUMBER OF CASES	120	93	64	54
DEATHS	40	27	11	8

Table LIX. The seasonal incidence and mortality of kwashiorkor.

according to season follows that of the number of cases as can be seen from the table. The age and sex incidence and mortality are given in Figure 60. The sex incidence is roughly equal, but the mortality amongst females is

FIGURE 60: age and sex incidence and mortality of 331 cases of Kwashiorkor seen at Tumutumu Hospital.

higher than that amongst males. The peak age incidence is during the second year of life during which period about sixty per cent. of this series occurred. The majority of the deaths occurred about the first and the second birthdays. The total case fatality rate was twenty-six per cent., which is lower than that in the series reported by Clark(1951a) which was thirty-five per cent. The Kikuyu cases of the syndrome show most of the clinical features defined by Brock and Autret(1952) with the exception of the skin lesions such as the crazy-paving dermatosis of the legs. The cause of death is often quite mysterious, but may be due to disturbances of the blood electrolytes as suggested by Trowell,Davies and Dean(1954). It may also be due to intercurrent infection, and in this series twelve children were noted as dying from bronchopneumonia, and eleven from gastro-enteritis.

The possible sequelae of kwashiorkor in those who survive have been thus described by Davies(1950): "Those who survive carry the scars of this episode into adult life in the form of a stunted growth, an abnormal, often cirrhotic liver, an inability to digest and assimilate food normally, swollen parotid glands, and, possibly, a form of cardiac damage known as endomyocardial fibrosis."

IV. DISEASES OF THE BLOOD:

The cases of diseases of the blood seen in this series were as follows:

Anaemia	9 cases
Purpura	7 cases
Leukaemia	2 cases
Haemorrhagic dis. of newborn	4 cases
Haemolytic dis. of newborn	3 cases

Only the first two categories are included in this section in the International Statistical Classification(1948). Leukaemia was dealt with in the section on neoplasms, and the two diseases of the newborn will be dealt with under Section XV which is concerned with diseases of early infancy.

There can be no doubt that anaemia is commoner than is suggested by our nine cases in ten years, but as these were the only cases in which anaemia was diagnosed they are the only ones recorded in our series. In other cases the primary condition was the only one mentioned in the notes, and the anaemia was not recorded although it may have been treated. Thus the anaemia of kwashiorkor is well-recognised, but not one of the cases of kwashiorkor had any observations about anaemia recorded in the case-notes.

Two of the cases of anaemia were diagnosed as megaloblastic; one was a female of twenty-three and the other a male of forty-five. Full investigation of these cases was not possible, but it is probable that they were

nutritional in origin for Addisonian pernicious anaemia has only once or twice been described in an African (Foy and Kondi,1952). The female was not pregnant.

The remaining seven cases were diagnosed as cases of iron deficiency anaemia. Two were males and five were females. All the females were well within the reproductive period and so possibly their anaemia was related to menstrual loss. The males were children aged two and four years and their anaemia may have been due to iron or protein deficiency. The diet of the Kikuyu is, however, not deficient in iron under normal circumstances for a high cereal diet contains a plentiful amount of iron(Walker and Arvidsson,1950), and hookworm infestation is not common, and malarial infections are mild with the result that true iron deficiency is very rare indeed. Protein lack would appear to be a more significant factor in the production of a deficiency anaemia.

The sickle cell trait has been found in Kikuyu patients but no estimate of its incidence is available and it is not known whether sickle cell anaemia occurs. Other forms of haemolytic anaemia are rarely seen. In this series we have cases of blackwater fever and of haemolytic disease of the newborn, but only very few.

Aplastic anaemia is very rare amongst the African people. No case of the primary type has been recorded. The secondary type is very rare for the African is not prone to take the drugs which produce this disease in European patients. I have seen one case in a Kikuyu patient which followed the administration of sulphonamide

drugs(Wilkinson,1956).

There were seven cases of purpura(296). In one case the etiology was obscure, but in six cases the diagnosis appeared to be that of onyalai, that type of thrombocytopenic purpura which appears in Africans and is distinguished by the occurrence of blood bullae on mucosal and skin surfaces. It occurs mainly in males, and five out of our six cases were males, and it is commonest in the early adult period of life. The range of ages in our series was from six to forty-six years. One case, a male of eighteen, died of a cerebellar haemorrhage and was reported in detail(Wilkinson,1953). This case and a later one seen at Tumutumu(Wilkinson,1955) are the only two so far published from amongst the Kikuyu tribe, but more have been seen as I have discovered from conversation with other medical officers in Kikuyu country. Onyalai appears to be much more common in Kenya than it is at present believed to be, and it is to be hoped that medical officers will publish cases as they see them so that a more complete picture can be built up of its incidence in East Africa.

African haematology has still much land to discover and possess. Much work is still needed to elucidate the blood diseases of the African. Foy and Kondi have recently been exploring the problem of anaemia in East Africans, and they confess that "the anaemia situation among Africans is undoubtedly complex"(Foy,Kondi,Hargreaves and Lowry,1950). Only long and patient study will solve the many problems of the haematologist in Africa.

V. MENTAL, PSYCHONEUROTIC & PERSONALITY DISORDERS:

The Kikuyu tribe shows the highest admission rate of any Kenya tribe to the Colony's mental hospital on the outskirts of Nairobi. Carothers(1948) gives the following admission rates for this hospital:

Kikuyu	9.3 per 100,000 of the tribe
Somali	9.0 per 100,000
Nandi	5.2 per 100,000
Kamba	2.1 per 100,000
Boran	1.5 per 100,000.

The reasons for this high admission rate are probably as follows:

1. The mental hospital is on the edge of the Kikuyu country and is a convenient place for the tribe to leave their mentally afflicated and therefore unwanted relations.

2. The Kikuyu people more than any other tribe have left their tribal lands in search of work, and it is well-recognised that the incidence of insanity amongst Africans working away from their home is higher than amongst those who stay at home.

3. The Kikuyu have progressed further in education than most tribes and have therefore attained to many positions of responsibility, the attainment of which has been found to predispose to states of mania.

4. The Kikuyu more than any other tribe has been subjected to the disturbing and detribalising influences of western civilisation in East Africa.

In the opinion of Carothers(1948),who is our most experienced East African psychiatrist, the incidence of insanity among Africans in their natural environment is very low. It is probably considerably increased amongst those who are working away from home, but is still low compared with the incidence found in Europe. One reason for this is the absence among the African of the organic diseases which produce states of mental disorder, such as arteriosclerosis and neurosyphilis, though we have seen that there is reason to suppose that the incidence of neurosyphilis will increase. Other reasons include the relatively high degree of exogamy which is found in African society and which reduces the influence of consanguinity in the aetiology of mental disease, and the well-organised tribal life which protects the individual from external stresses.

We have already seen how infections form a large proportion of the diseases seen in the Kikuyu, and this is true of most African tribes. It is not surprising then to find that "the part played by infections is a large one"(Carothers,1953) in the causation of mental disease. This is illustrated in our series by the occurrence of twenty-one cases of psychosis due to malaria which have already been referred to under that disease. Another factor which has been insufficiently recognised is malnutrition which may have a insidious but nevertheless real influence on the development of mental disease(Carothers,1953).

Depressive states appear to be uncommon amongst

Africans, and the two patients classified as suffering from a manic-depressive reaction were cases of mania. One was a female of thirty years, and the other a male of twenty-three. There were eight cases of dementia which could not be further analysed as to cause or type.

Anxiety states are uncommon in the African, in whom hysteria and transient episodes of "frenzied anxiety" are the commonest form of psychoneurosis(Carothers,1948). James(1944) reported on his experience as a psychiatrist in the East Africa Command during the recent war, and gave the following significant figures for the proportion of psychiatric cases made up of anxiety states and hysteria in European and African troops.

RACE	ANXIETY STATE	HYSTERIA
European	54.4%	0
African	6.4%	56.6%

James points out that the African patients who showed an anxiety state were generally of the better educated type.

Our five cases of hysteria were all females whose ages ranged from seventeen to thirty-four. The usual complaint was of some form of anaesthesia of the hand or arm. In one case it was paralysis of both lower limbs.

Alcoholism is much commoner than our three cases would suggest, and these three men were only admitted for treatment of wounds sustained in a drunken brawl.

Carothers(1948) has stated that it is not possible to estimate the incidence of mental defect amongst the

African population. Our series contains eight cases, all of whom were males aged from three to eleven years. One was a Mongolian idiot aged three. Another was a microcephalic also aged three, whilst another aged eleven years showed bilateral congenital cataracts.

African psychiatry is still in its infancy and there is much that we do not know about the African mind and its disorders.

VI. DISEASES OF THE NERVOUS SYSTEM & SENSE ORGANS:

Nervous disease forms only 1.9 per cent. of Tumutumu Hospital discharges over the decade under review. This low figure supports the general clinical impression that organic nervous disease is less common amongst Africans than amongst Europeans. There is no doubt, however, that many more cases of such disease have been seen than have been published, and so until clinical experience in Africa has been recorded and collated it is impossible to establish the true incidence of organic nervous disease there.

In 1944 Muwazi and Trowell analysed 269 cases of neurological disease seen over a period of two years in Uganda Africans. Their series is compared with our own in Table LX. There are some striking differences between the two lists. The high incidence of neurosyphilis in the Uganda series bears out what we have already seen, viz. that Uganda is further advanced in syphilisation than Kenya is. It is, of course, possible that some of our cases were syphilitic in origin and this was not discovered.

LESION	UGANDA SERIES	TUMUTUMU SERIES
Cranial nerve lesion	4	0
Intracranial tumour	2	3
Hydrocephalus	2	12
Cerebral haemorrhage	2	8
Meningitis	34	142
Encephalitis	17	0
Poliomyelitis	4	5
Herpes zoster	1	11
Cerebral malaria	12	37
Trypanosomiasis	4	0
Relapsing fever	1	0
Tetanus	2	137
Neurosyphilis	137	0
Parkinsonism	2	2
Spinal lesions	5	1
Peripheral neuritis	5	3
Coma	8	0
Epilepsy	6	44
Neurosis	19	7
Hemiplegia	2	9
Motor neurone disease	0	1
Friederich's ataxia	0	1
TOTAL	269	423

Table LX. The incidence of nervous disease in hospital patients seen in Kampala and in Tumutumu.

At Tumutumu we see many more cases of tetanus than they do at Kampala for we serve a rural community, and they an urban one. In interpreting the table it must be borne in mind that the Uganda series covers a period of only two years as against the ten years of the Tumutumu series.

Vascular lesions of the C.N.S.:

There were three cases of spontaneous subarachnoid haemorrhage(330), all of whom were males. Two aged thirty and thirty-six, died and one aged eighteen survived. At autopsy one showed an aneurysm at the bifurcation of the right middle cerebral artery, whilst no definite lesion could be found in the other patient.

Two of the five patients with cerebral embolism or thrombosis were males aged forty and fifty years. The three females were aged thirty-four, fifty and eighty years respectively. All died except the male aged forty. It is possible that the underlying lesion in some of these cases was syphilitic, but no Kahn reaction was done.

The nine cases of hemiplegia unspecified(334) were probably due to cerebral vascular disease. Two were noted to have signs of bulbar paralysis. In four cases the hemiplegia was on the left side, and in five on the right. Two patients were female and the rest male. The age range was from thirty to seventy. Three died, two were males aged sixty and sixty-eight, and one was a female aged seventy.

Purulent meningitis(340):

It is unfortunately not possible to classify our cases of meningitis on a bacteriological basis. I discovered in 1953 that the laboratory assistant was unable to differentiate between the meningococcus and the pneumococcus after staining a smear by Gram's method. Thus all our cases are classed together as purulent meningitis, though it is probable that a large proportion of them were pneumococcal in origin.

Meningitis first appeared in Kikuyuland in 1913 when a great epidemic of what was probably meningococcal meningitis swept through the country. Dr Philp(1919) estimated that at least twenty thousand people died in Kikuyu country. This epidemic is said to have begun in Nairobi. Throughout the South Nyeri District several quarantine stations were established to try to check the spread of the disease, and some of these became the sites of later dispensaries. We have already seen how the station set up at Nyeri determined the site of the Nyeri Government Hospital.

The annual incidence of the disease is given in Figure 61 and related to the average annual rainfall. There appears to be an inverse relationship with the greater number of cases occurring in the drier years. The monthly discharges are given in Figure 62 along with average monthly rainfall. If we assume that most cases who were discharged were actually admitted during the previous month and so the true curve of incidence of the disease should be one month earlier than the present one

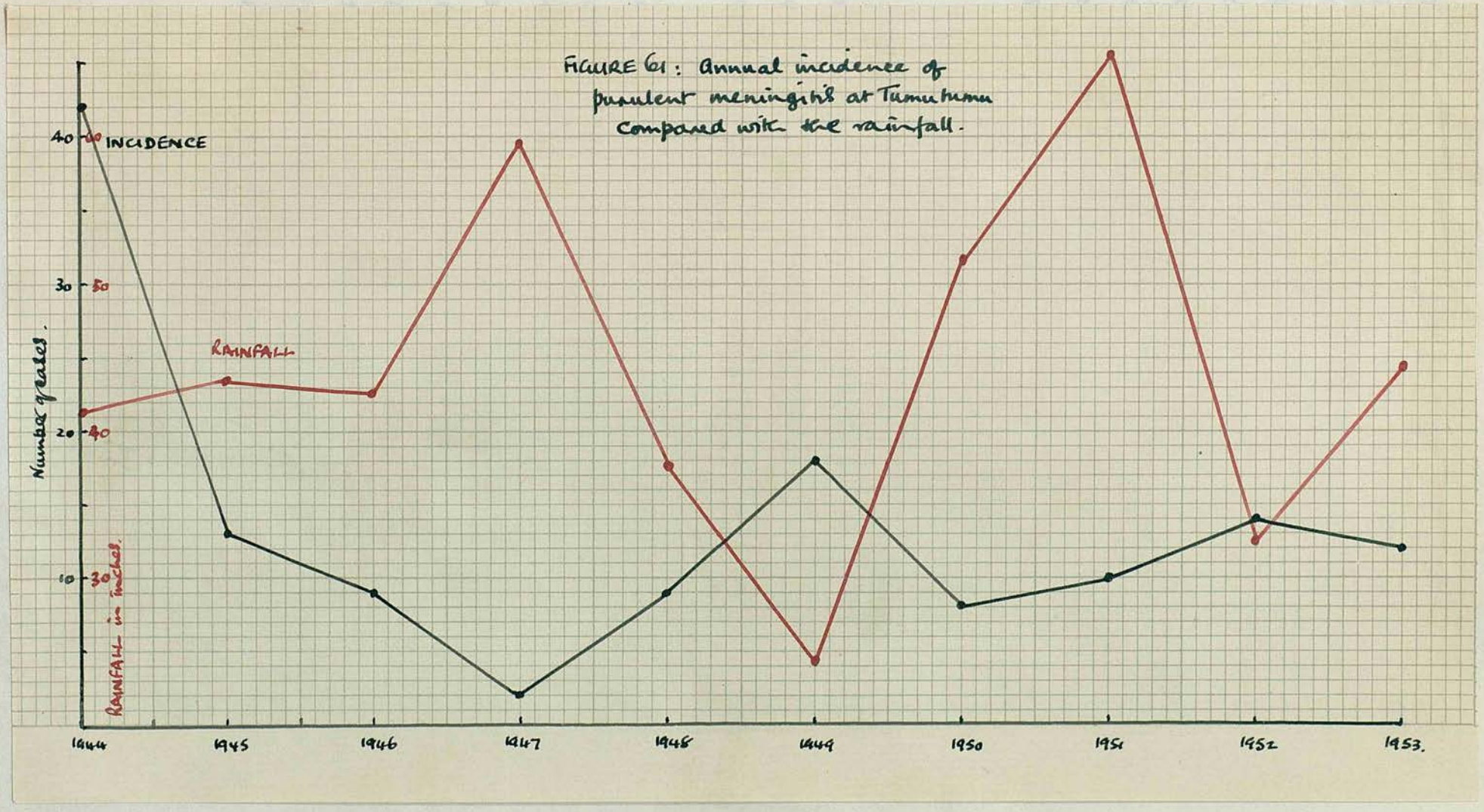


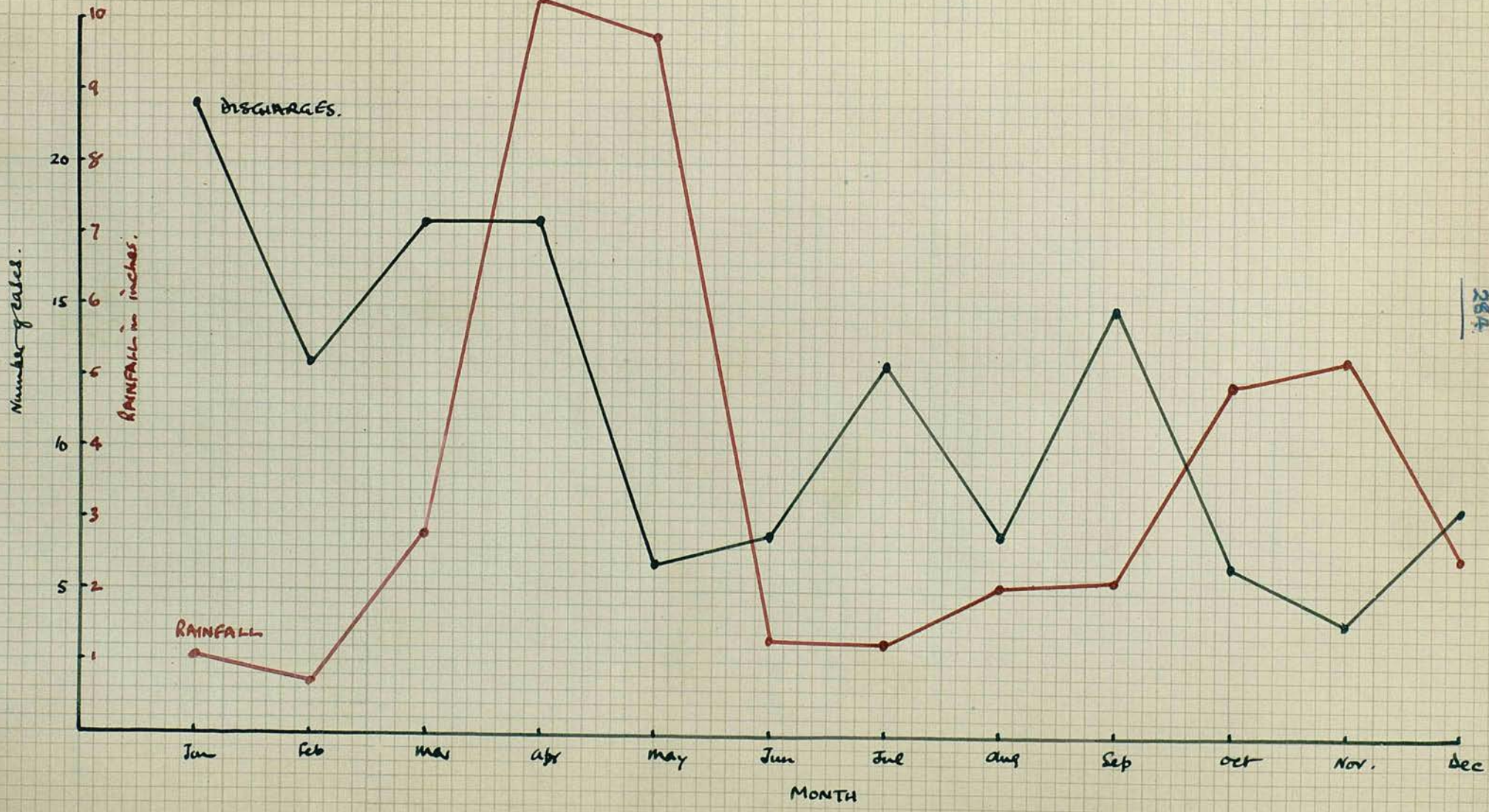
FIGURE 61: Annual incidence of purulent meningitis at Tumutumu Compared with the rainfall.

then we can see that there appears to be an inverse relationship between the incidence of the disease and the rainfall. The disease is therefore commoner during the dry months which are those of the dry and dust-laden winds which irritate the nasopharynx which is the usual portal of entry of the meningococcus. This agrees with the experience of Waddy(1952) in West Africa, but though our figures are suggestive, they are too small to base any firm conclusion upon.

The age and sex incidence of our series is given in Figure 63. The sex incidence is roughly three males to two females. None of our cases was over the age of forty years. The peak age incidence was in the age group 5-14 years, closely followed by the 1-4 years group, and then by the 0-1 years group.

The case fatality rate of the disease in our series was just over fifty-one per cent., which is very high indeed and, amongst the infections is only exceeded by tetanus which showed a case fatality rate of over fifty-three per cent. In the first year of life this rate rose to about eighty per cent. and this suggests that a good proportion of these cases in the first year of life may have been pneumococcal in origin for it is well known that pneumococcal meningitis carries a much higher mortality than the other types.

Figure 62: Monthly discharges of PURULENT MENINGITIS from Jumutumu Hospital compared with the mean monthly rainfall.



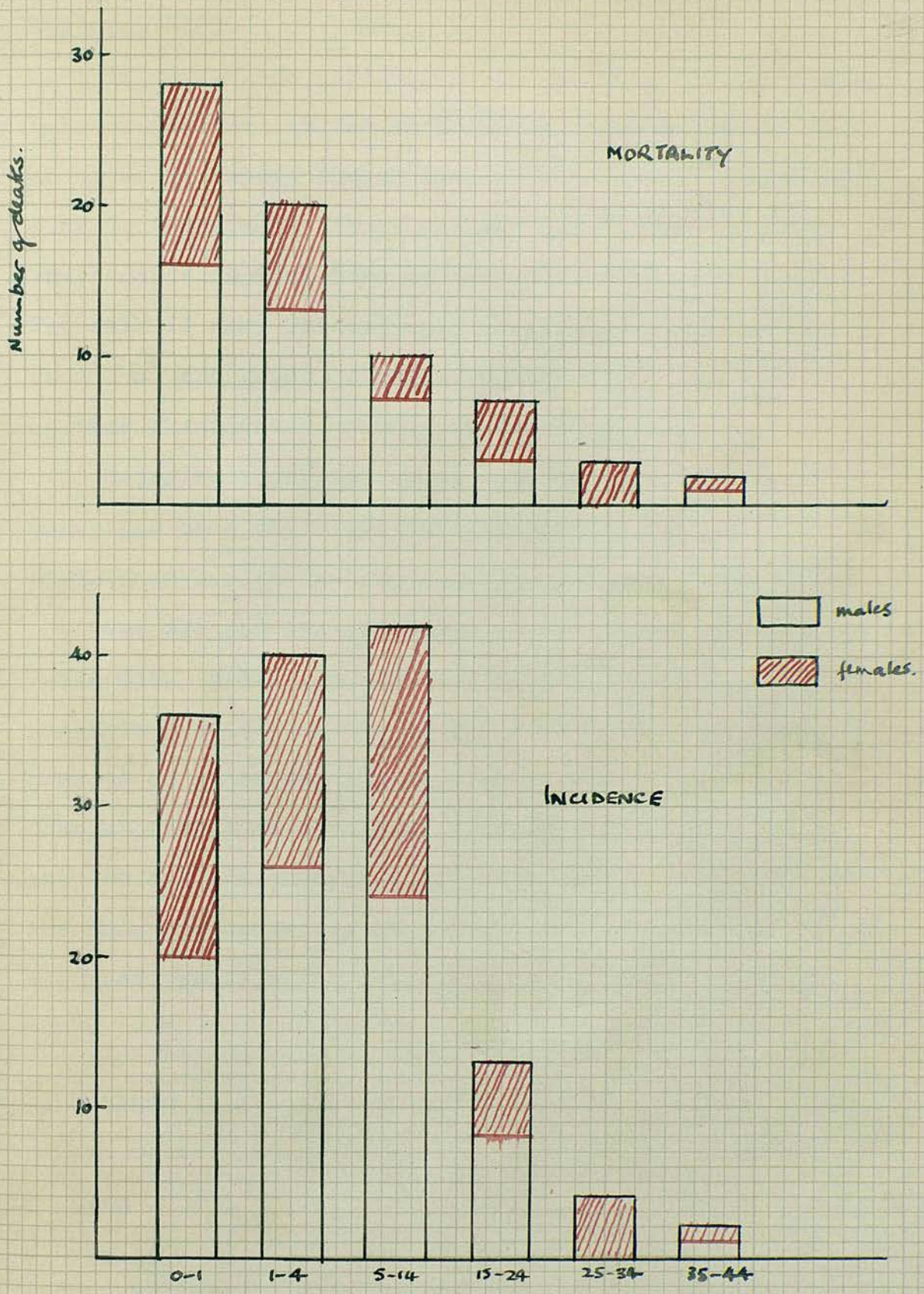


FIGURE 63. age and sex incidence and mortality of purulent meningitis. (137 cases admitted to Tumuteuma Hospital).

Epilepsy(353):

If we exclude infections, epilepsy is the commonest nervous disorder we see at Tumutumu. All our cases were of major epilepsy, though the minor form does occur from time to time. The Kikuyu now use the Swahili term for the disease as they have no special word of their own. The Swahili name for epilepsy is kifafa which is derived from the verb kufa, to cease to act, feel, or live. It is thus the disease which produces unconsciousness.

Major epilepsy not uncommonly presents as a burn sustained by a fall into the fire during a convulsion. Sixteen of our forty-four cases presented in this way.

The age and sex incidence of our series is given in Table LXI. Males are affected more than females in the proportion of almost two to one. Of those cases who came to us as burns, ten were males even though the females have more work with fires than the males since they do all the cooking. It is probable therefore that the male preponderance is a real one, although in European practice the sex incidence is almost equal.

AGE GROUP	1-4	5-14	15-24	25-34	35-44	45-54	TOTAL
MALE	1	6	9	7	1	4	28
FEMALE	3	2	5	3	2	1	16
TOTAL	4	8	14	10	3	5	44

Table LXI. The age and sex incidence of major epilepsy.

The age group most affected was the 15-24 years group. Unfortunately it is not possible to distinguish primary and secondary types of epilepsy in this series. Martin and Elkington(1946) suggest that any case of epilepsy whose fits began after the age of twenty-five years should be regarded as secondary or symptomatic epilepsy. No less than eighteen of our cases were over twenty-five years and so it is possible that some were suffering from secondary epilepsy, but as the history of the onset of fits was not reliable, nor always recorded, it is not possible to be definite. It is possible that some cases might be syphilitic in origin as McElligott(1949) has suggested.

We have no record which attributes death to epilepsy in any case, but seven of the patients who were brought in with severe burns after falling in the fire during a fit died as a result of the burning, and thus death was a secondary result of epilepsy.

With regard to the incidence of epilepsy in the community as a whole, this is impossible to assess for there must be many cases who never come near a medical station. It is possible that more will be encouraged to seek medical aid as a result of the more public life Kikuyu families lead in the new villages. Formerly, such cases could stay in their homestead and never appear in public, but this is not possible under the new scheme, and so more cases will probably come to light now.

Other diseases of the C.N.S.:

In 1931 it was stated that the occurrence of paralysis agitans was not infrequent in Kenya(Kenya Medical Department,1931), but we have had only two cases in ten years. A male of fifty years, and a female of seventy who died finally from a complicating bronchopneumonia.

The case of motor neurone disease was a male of about forty years of age. From the case notes it appears to have been an amyotrophic lateral sclerosis. Gelfand(1948a) states that he has never seen a case in Southern Rhodesia, but recently Harries(1955) has described two cases from Nairobi, one of which was in a male Kikuyu aged thirty. Muwazi and Trowell(1938) note that they have seen a few cases of this disease which, however, were not confirmed as such on post-mortem examination.

The case diagnosed as one of Friedreich's ataxia was in a girl aged ten years. No family history was recorded, and the notes were not very adequate. It is the only case I have heard of in an African patient.

The six cases entered in Table XLI as other cerebral paralyses were all patients with spastic paraplegia whose aetiology was obscure. There were four males aged ten to thirty-six years, and two females aged ten and thirty. The older female patient died.

This discussion of nervous disease is unsatisfactory because so much is unknown and inadequately investigated due to the lack of facilities in a rural hospital.

Nervous disease is a relatively unexplored field of African medicine, and we still do not know which diseases occur, and which do not. From our limited experience at Tumutumu it would appear that apart from the infections and epilepsy, organic nervous disease is not common. It may be of interest to list those diseases which have never been described, or only very rarely described, in the African. These diseases include:

The demyelinating diseases,
Motor neurone disease,
Subacute combined degeneration of the spinal cord,
Syringomyelia,
The muscular dystrophies,
The myotonic dystrophies,
Amyotonia congenita,
Myasthenia gravis,
The hereditary ataxias,
Migraine,
Trigeminal neuralgia, and
Hypothalamic syndromes.

These diseases may occur in the African, but if so they must be very rare. One case of disseminated sclerosis has been described in a Kikuyu male of forty years of age by Goldstein(1946), but no other case has ever been reported. We badly need information based on simple clinical observation of cases of nervous and other diseases.

Diseases of the eye:

It is estimated by Calcott(1954) on the results of his sample surveys of the population, that there are about three hundred thousand Africans in Kenya who require treatment for eye disorders. This means about six per cent. of the population. The incidence of blindness in East Africa is reckoned at one per cent. The cause of about eighty per cent. of this blindness is corneal scarring which is preventable in most cases. Corneal scarring may follow three types of lesion: purulent conjunctivitis, traumatic corneal ulceration, and trichiasis following trachoma. These lesions form the bulk of our inpatient discharges for eye diseases. The commoner eye conditions which were severe enough to require inpatient admission for treatment were as follows:

DISEASE	NUMBER of CASES	PERCENTAGE of EYE CASES
Trachoma	80	21.3
Conjunctivitis	115	30.7
Corneal ulcer	53	14.1
Cataract	44	11.7
Entropion	25	6.7
TOTAL	317	84.5

Trachoma has already been commented on under the section on Infective and Parasitic Diseases. The cases of acute conjunctivitis which were admitted to hospital for treatment were usually purulent in type. Milder cases were treated as outpatients, and we have seen in Table

XXXIX that 745 cases of inflammatory diseases of the eye were seen as outpatients at Tumutumu Hospital over three years. The peak incidence of acute purulent conjunctivitis was in the first year of life in which twenty-eight cases occurred, with the age group 15-24 years following closely with twenty-two cases. A third of the cases occurred in the long wet season of the year. The 115 cases dealt with here do not include those thirty due to gonococcal infection which were mentioned under Gonorrhoea.

Of the forty-four cases of cataract three-quarters were men. This may be due to the fact that men more readily come to hospital than women when they are old or that the men live longer than the women, both of which reasons could explain the difference in sex attendances over the age of forty-five seen in Table XXXIV. The age and sex incidence of cataract is shown in Table LXII.

	5-14	15-24	25-34	35-44	45-54	55-64	65-74	TOTAL
MALES	3	1	1	8	11	8	1	33
FEMALES	0	0	0	2	5	2	2	11
TOTAL	3	1	1	10	16	10	3	44

Table LXII. The age and sex incidence of cataract.

Boase(1952) found that cataract occurred in quite young African patients in Uganda, and our figures suggest an earlier age incidence than that usually seen in European practice. Of the three cases seen in the age group 5-14

years, two were patients with congenital cataracts, and one had a traumatic cataract.

Diseases of the ear & mastoid process:

The majority of cases of otitis media are treated as outpatients. An average of 102 cases are seen in Tumutumu Hospital Outpatient Department each year, but only about eight are admitted to hospital. These latter are chiefly those who have failed to respond to out-patient treatment and are therefore a selected group. The age and sex incidence of these cases is shown in Table LXIII. The infection is commoner in males, and is commonest in the 1-4 years age group, with the 5-14 years group not far behind.

	0-1	1-4	5-14	15-24	25-34	35-44	45-54	TOTAL
MALES	2	17	15	9	3	2	1	49
FEMALES	1	11	9	5	3	0	1	30
TOTAL	3	28	24	14	6	2	2	79

Table LXIII. The age and sex incidence of otitis media.

The eight cases of acute mastoiditis all complicated otitis media. Four were in males and four in females, and all were under eighteen except two, one male of thirty-two and one female of sixty-eight.

VII. DISEASES OF THE CIRCULATORY SYSTEM:

To a person trained in European medicine, it comes as a surprise to discover how relatively small a place disease of the cardiovascular system has in African medical practice. In our series of inpatient discharges from Tumutumu Hospital only 0.5 per cent. were of persons suffering from disease of the cardiovascular system. When it is realised that almost forty per cent. of these cases were suffering from lymphoedema, this makes the incidence of organic cardiac and arterial disease lower still.

Although the picture of the incidence of diseases of the circulatory system amongst the peoples of Africa is by no means complete, it does appear that the types of such disease seen in Africa show a different pattern from that seen amongst the peoples of Europe. Thus our series does not contain a single case of ischaemic or hypertensive heart disease, nor have we ever heard of one from any of our colleagues. Arteriosclerosis does not occur in our series, and is generally acknowledged to be rare amongst Africans in their natural surroundings. The absence of these diseases is noteworthy in view of their frequency amongst European populations. This difference in incidence probably contains important clues to the aetiology of these diseases were we but able to discover them.

African patients do not report sick with cardiac symptoms so readily as European patients do. They only come when the symptoms are severe and incapacitating, and the local medicine man has failed. This means that most cases are admitted in advanced cardiac failure. Often the primary cause of the failure has been obscured and is not easy to determine. Treatment is often very disappointing, and cases may show little or no response to digitalis. The result is that the case fatality rate in cardiac disease is high. Fifteen out of twenty-two patients with cardiac failure died in hospital, and fifteen out of twenty patients with mitral disease.

Even when they do report sick with cardiac disease it is usually impossible to obtain an adequate and reliable history of the possible cause of the disease, of its progress, and even of its duration. This is true of history-taking in any disease in Africans, but it is particularly unfortunate in cardiac disease since it is very difficult to obtain a clear history of rheumatic fever in cases which appear to be rheumatic in origin.

The diagnosis is purely clinical in most cases, but can often be confirmed post-mortem. Outside Nairobi and Kampala there is no adequate diagnostic unit for cardiac disease in East Africa.

Finally, it is usually impossible to make an African understand the need for living within the capacity of his heart's reserve. His outlook on these things is very philosophical, and he would not really understand John Hunter's saying that his life was in the hands of any

knave who chose to annoy him. In most cases, and more especially if they are women, it is impossible to regulate their life and activity within the limits of strength of the failing myocardium, for they must needs carry on the work prescribed by tribal custom for them to do until they are physically incapable of doing so.

The aetiology of heart disease amongst the Kikuyu:

Most cases are due to infection. The small group of congenital heart lesions is of unknown origin. Rubella is not described as occurring amongst African patients. Gelfand(1947a) does not mention it in his book, "The Sick African", and I have never diagnosed a case, nor have any of my colleagues. However, the fleeting rash would be difficult to identify on the pigmented African skin, and it is possible that the disease does occur and may be responsible for some of the congenital malformations seen in the Kikuyu.

The two main infections which are responsible for heart disease in the Kikuyu are rheumatic fever and tuberculosis.

Rheumatic fever: The occurrence of rheumatic fever in the tropics has for long been a source of controversy. After thirty years' experience in Malaya Clarke(1927) told the Royal Society of Medicine that "rheumatic fever does not occur in the tropics." Donnison(1930) said it did occur in the Kenya African, but it was rare. Williams(1939) writing from Kampala said that he found the evidence of rheumatic lesions in Uganda "not entirely

convincing".

There is no doubt at all, however, that acute rheumatism occurs amongst the Kikuyu of South Nyeri District. Three cases were diagnosed as rheumatic fever in this series, and it is possible that more were missed and regarded as non-specific fevers. It is possible, of course, to misdiagnose a case as one of rheumatic fever, but typical rheumatic chorea is unmistakable, and there were thirteen cases in our series, two of whom were under my own observation. No one has yet described rheumatic nodules in the African, but it must be remembered that these only occur in about ten per cent. of cases and are less common now than they were twenty years ago. A further reason for believing that rheumatic fever does occur amongst our people is the incidence of mitral stenosis. Twenty cases of this lesion were seen in our series. In none of these cases was a clear history of rheumatic fever obtained, but we have already noted how difficult it is to obtain any kind of reliable history from our African patients.

Since the incidence of rheumatic fever is not very marked in these days, it is difficult to explain the findings of Dr Philp recorded in early annual reports of Tumutumu Hospital. The following figures are taken from these to give the incidence of cases diagnosed as suffering from rheumatic fever in earlier years:

YEAR	1916	1917	1918	1919	1920	1921
Cases	16	40	17	59	36	92

Together with these figures must be taken his estimate of the incidence of organic heart disease amongst African recruits for the East African Forces in the first world war. He found an incidence of one case per thousand men amongst fifteen thousand that he examined in Fort Hall and South Nyeri Districts. It would seem that rheumatic infection was much more common in earlier years(Philp,1916).

There is no doubt that rheumatic fever does occur in the tropics. Our small experience of it is supported by reports from elsewhere in East Africa. Thus Williams, Ball and Davies(1954) found 8.7 per cent. of a series of cases of cardiac failure which came to autopsy to be rheumatic in origin. The whole series numbered 231 cases.

Tuberculosis: Two cases of adherent pericardium were seen in this series, and they were probably due to tuberculosis. It is probable, however, that tuberculosis of the heart is much commoner than this and it is being increasingly recognised in East Africa.

Other infections: We have not found evidence in the Kikuyu of South Nyeri District of syphilitic disease of the cardiovascular system apart from one fatal case of aortic aneurysm seen in the Consolata Hospital. This infection does not appear to be common yet in Kenya, but it is not uncommon in Uganda where Williams, Ball and Davies(1954) in the autopsy series already referred to found evidence of syphilitic aortitis in no less than 14.7 per cent. of the cases. This illustrates the more advanced stage of syphilisation reached in Uganda Africans

and previously referred to when we commented on syphilis.

There were three cases of acute pericarditis. One complicated acute lobar pneumonia in a female of twenty-eight. The cause of the other two was unknown.

One case in a male of twenty-four was diagnosed as suffering from subacute bacterial endocarditis. He had mitral and aortic valve disease and he died of a cerebral embolus. The organism was unknown.

Disease of the coronary arteries played no part in the aetiology of heart disease in our series, nor in the autopsy series from Uganda referred to above. In the Uganda series there were six cases diagnosed as essential hypertension which had produced cardiac failure and death, as well as thirty-seven cases which formed sixteen per cent. of the series due to hypertension of renal origin. In our series we saw no cases of hypertension. Hypertension is very rare amongst Africans in their normal environment. Those who have investigated the blood pressure in Africans have found that the readings are comparable with those in Europeans until the age of forty years but thereafter it tends to fall in the African and to rise in the European(Donnison,1929 and Williams,1941). This difference does not appear to be due to racial factors because in the United States hypertension is said to be even commoner amongst the negroes than it is amongst the white population(Lewis,1942).

Pulmonary heart disease is seen occasionally in the chronic form, but is not represented in this series.

Before we leave the question of aetiology, we must refer to the condition of endomyocardial fibrosis which has come into prominence recently, and which may explain some of our cases of cardiac failure of unknown origin. The condition was first described by Josserand and Gallavardin in 1901, but was forgotten until Bedford and Konstam described some cases from West Africa in 1946. Then O'Brien(1954) described some cases in the Sudan, and Williams, Ball and Davies(1954) gave a full description of the condition as they saw it in Uganda. The Uganda workers found thirty-five cases in a series of 167 cardiac inpatients, and thirty-three cases in a series of autopsies on 231 patients dying from cardiac failure. These figures suggest that the syndrome is not uncommon, and is not being recognised as frequently as it should be. Its causation is obscure. It has been suggested that it is another manifestation of the fibroplasia to which Africans are so prone, and that it may be another member of the collagen group of diseases, or perhaps one of the possible sequelae of chronic protein malnutrition(Davies,1950).

Rheumatic fever:

Two of the cases of rheumatic fever were in females who were aged eighteen and twenty-four years. The male case was thirty-five years old. Unfortunately it has not been possible to follow them up to see if they developed rheumatic carditis.

The sex and age incidence of chorea rheumatica is

given in Table LXV. The figures are too small to be of signficance, but they suggest a female sex preponderance, and that the disease is commonest in the age group 8-12 years.

AGE IN YEARS	3	6	7	8	9	10	12	13	14	TOTAL
MALE	0	1	1	1	0	0	1	0	1	5
FEMALE	1	0	0	2	1	2	1	1	0	8
TOTAL	1	1	1	3	1	2	2	1	1	13

Table LXV. The age and sex incidence of rheumatic chorea.

Valvular heart disease:

The valvular lesions of the heart seen in this series were as follows:

Mitral stenosis	20 cases
Aortic incompetence	2 cases
Aortic stenosis	1 case
Combined mitral & aortic lesion	1 case
Unspecified	1 case

The case of aortic stenosis was presumed to be congenital in origin and is included under Congenital Heart Disease(754). The combined lesion was present in a patient who developed bacterial endocarditis.

In these cases the chief valve which was attacked is the mitral valve which suggests that the underlying lesion was rheumatic in nature. Donnison(1928), however, concluded from his experience in the South Kavirondo country of Western Kenya, that the aortic valve was more often attacked than the mitral by rheumatic fever in the African. He examined over twelve thousand labour recruits and found ten cases of heart disease, and they were all suffering from lesions of the aortic valve. In our series the mitral valve was chiefly affected, but it impossible to prove that the lesion was rheumatic though there is a strong presumption that it was.

Sixteen of the patients with mitral stenosis were admitted in cardiac failure, and fourteen of them died. The remaining four were admitted for other causes, and one of these died from the results of the mitral stenosis. Three patients in the first group, a male of twenty-eight and two females aged twenty-eight and thirty, showed auricular fibrillation on admission, and the male and older female both died.

The age and sex incidence of the cases of mitral stenosis is given in Table LXVI along with the mortality from the lesion. In this small series males are more affected than females and show a higher mortality. The two age groups in which the lesion was most commonly diagnosed were those of 10-14 years and 25-29 years.

AGE GROUP		10-14	15-19	20-24	25-29	30-34	35-39	TOTAL
MALE	cases	4	2	1	5	0	0	12
	deaths	3	2	1	4	0	0	10
FEMALE	cases	3	0	0	2	1	2	8
	deaths	1	0	0	1	1	2	5
TOTAL	cases	7	2	1	7	1	2	20
	deaths	4	2	1	5	1	2	15

Table LXVI. The age and sex incidence and mortality of mitral stenosis.

The two patients with aortic incompetence were both females, and were aged eight and ten years. Both were admitted in cardiac failure, and the younger one died. It is unlikely that either of these cases were due to syphilis in view of their age. Our experience in South Nyeri District does not bear out the statement of Manson-Bahr(1954) that "valvular disease of the heart in the tropics is usually syphilitic."

Disorders of cardiac rhythm:

African patients do not appear to be so conscious of changes in the rhythm of the heart beat as Europeans are, and therefore do not so readily seek advice about them. The more educated Africans not uncommonly

worry about the occurrence of extrasystoles, but the mass of the people never complain of disturbances of the beat of the heart.

The arrythmias of the heart beat seen in this series were three in number. Sinus arrhythmia was seen in one patient and recorded in his notes, but is infact just as common in the African as it is in the European. It often provides a convenient test of just how much notice an African nurse has taken of a pulse he or she has examined. Paroxysmal tachycardia was present in three females whose ages were fourteen, twenty-four and thirty. Auricular fibrillation was present in three of the cases of mitral stenosis, and already been mentioned. Pathological bradycardia has not been recorded in an African in East Africa so far.

Congestive cardiac failure:

A total of forty cases were admitted to hospital with cardiac failure and thirty of them were fatal. They may be classified as follows:

Due to mitral stenosis	16 cases	14 deaths
Due to aortic incompetence	2 cases	1 death
Due to unspecified causes	22 cases	15 deaths

The age and sex incidence of the cases due to unspecified causes is given in Table LXVII. Females predominate over males, which may be explained by the fact that the females do the heavy and hard work in the Kikuyu tribe. It is they who carry the heavy loads, plant and weed the garden, and bear the children. Four cases occurred in

the 15-24 years age group and it is probable that these were really congenital cardiac lesions beginning to cause myocardial breakdown. Seven cases with five deaths occurred in the 45-54 years age group, and five cases with four deaths in the 55-64 years group.

	5-14	15-24	25-34	35-44	45-54	55-64	OVER 75	TOTAL
MALE	0	1	1	2	2	2	1	9
FEMALE	1	3	1	0	5	3	0	13
TOTAL	1	4	2	2	7	5	1	22

Table LXVII. The age and sex incidence of congestive cardiac failure.

The case fatality rate of these cases was seventy-five per cent. which is a very high figure indeed, especially in view the fact that all the modern remedies for cardiac failure were available and were used intelligently. My own experience of these cases is that they do not respond to digitalis in the way European patients do. The reason for this is not clear. The preparations used were fresh and potent. Perhaps they come too late, or perhaps some of the cases are due to endomyocardial fibrosis which may not respond well to digitalis. Whatever the cause may be, it is very distressing to find that in spite of our modern drugs these patients die.

We have already referred to the cases of infection of the heart in this series. There remains only one case

to mention. It was a case of an enlarged heart of unknown aetiology in a girl of ten years.

Diseases of blood vessels:

There are no cases of arterial disease in our series. We have already discussed the cases of cerebral vascular disease, but found very little to guide us in discovering the state of the underlying arterial wall. Arteriosclerosis as seen in Europeans does not appear to exist in Africans, even if they do live into the later age groups. Gelfand(1947b) described a condition of symmetrical gangrene of the feet in the Mashona people which he thought might have been due to arterial spasm, but nothing like this has been seen in East Africa.

The diseases of veins which were seen in our series were as follows:

thrombophlebitis	8 cases
varicose veins	3 cases
haemorrhoids	3 cases
pulmonary embolism	1 case

Thrombophlebitis occurred in eight cases, four males and four females. In two of the female cases it followed childbirth, and in one case it caused death. In all cases it was the lower limb which was affected. No cases of primary tropical phlebitis were recognised amongst our cases, and it is of interest to note that Fisher who first described this condition in 1941 said some eleven years later that the disease "had practically disappeared from

our wards"(Fisher & Nixon,1952).

Varicose veins are surprisingly rarely seen amongst Africans. Only three cases occur amongst our inpatient discharges. Two were males aged twenty-eight and thirty-five, and the female was aged twenty-five years. One of the males had an ulcer too, but it was more typical of a tropical ulcer than a varicose one. No cases of varicose veins were recorded amongst the outpatients which means that none came up to hospital complaining of this lesion.

Haemorrhoids likewise do not appear to be common for only three cases occurred amongst our inpatient series. Two were males aged forty-two and forty-five, and one was a female aged thirty-four. They all came to hospital complaining of pain and bleeding.

The patient who died from pulmonary embolism was a young woman of twenty-two who collapsed after an abdominal operation. An embolus was found across the bifurcation of the pulmonary trunk at autopsy. This is the only case of pulmonary embolism that I have seen in a Kikuyu in ten years in Kikuyuland. This experience is similar to that of other medical officers to whom I have spoken and who have experience of medical work amongst the Africans of Kenya. This condition does not appear to be common amongst Africans, and it is difficult to suggest any reason for this in the present state of our knowledge.

Lymphoedema:

There were sixty cases of elephantiasis or lymphoedema in our series. In forty-four cases both legs were affected, in nine the right leg only, and in seven the left leg only. The age and sex incidence is given in Table LXVIII. The sex incidence is equal, and a third of the cases occurred in the 25-34 years age group. There is a tendency for the female cases to be younger than the male ones which is difficult to account for.

	5-14	15-24	25-34	35-44	45-54	55-64	OVER 65	TOTAL
MALE	2	4	10	8	2	2	3	31
FEMALE	3	9	10	3	2	2	0	29
TOTAL	5	13	20	11	4	4	3	60

Table LXVIII. The age and sex incidence of lymphoedema

The Kikuyu name for this disease is mahahinya which is the plural form of kihahinya which means the dorsum of the foot. We may translate it as the disease which increases the dorsum of the foot.

The cause of this condition is infection. This is not filarial for we have no species of filaria in South Nyeri District. The course of events appears to begin with the entry into the skin of the toes of the chigger flea(Tunga penetrans). The chigger is removed with a metal skewer which is not sterilised before use, and often the chigger burrow becomes infected and a

lymphangitis results. This recurs when a later chigger burrow is infected and with the recurrent infections the lymph channels become blocked by coagulated lymph and fibrous tissue. This interferes with the lymph drainage of the lower limb and so lymph begins to collect in the tissues and produce the swollen limb of elephantiasis. There is only one objection to this explanation and that is the observation that under resting conditions tissue fluid can be adequately removed by the venous blood without the assistance of the lymphatics according to Samson Wright(1952).

The degree of severity of the condition varies and some cases responded to rest in bed with elevation of the affected limbs. In twenty-five cases some form of the Kondoleon operation was carried out. Lymphoedema is not easy to treat, and Aird(1950) comments that "the surgical treatment of lymphoedema has been more ingenious than successful."

VIII. DISEASES OF THE RESPIRATORY SYSTEM.

Amongst outpatients seen at Tumutumu Hospital those with respiratory symptoms formed the second largest category of patients seen. Amongst inpatients diseases of the respiratory system formed the largest group of discharges for any of the systemic groups of diseases, and they were responsible for more deaths than the diseases of any other system of the body.

The conditions under which the Kikuyu live render them susceptible to chills and respiratory infections. They live in huts which are commonly damp and ill-ventilated. In these huts they breathe an acrid irritating atmosphere which results from the burning of a log fire without any chimney for the smoke to ascend. Their clothing is inadequate to keep their bodies warm. They are almost constantly wet during the wet season and their wardrobe is not sufficient to allow them to change their wet clothes. Their general resistance is lowered by malnutrition, and their lungs are damaged by the migration of roundworm and hookworm larvae. In these conditions it is not at all surprising that respiratory infections are common amongst the Kikuyu.

The diseases of the respiratory system in our series are almost all infections, and almost all acute infections. The absence of chronic lung diseases is very striking although it is unlikely that this is a true reflection of its absence amongst the general population. People

with chronic lung disease in a primitive community would not be so likely to attend hospital as those with an acute infection, and if they did they would be more likely to be treated as outpatients because of the need for beds for more acutely ill patients. These two facts are the probable explanation of the absence of chronic respiratory diseases from our series.

Acute tonsillitis(473):

Hypertrophy of the tonsils and adenoids does not appear to be so common amongst the African as amongst the European, and no cases were diagnosed as such in our series. Such hypertrophy does, however, occur but it is not possible to give any estimate of its incidence.

There were one hundred and thirty cases of acute tonsillitis in our series. They showed no special annual or seasonal distribution. The age and sex incidence is given in Table LXXI. The female incidence is almost twice that seen in the male. This may be related to the fact that the female sits or stands over the fire whilst coooking and therefore inhales the acrid irritating fumes and smoke of the fire.

No details were available about the bacterial aetiology of these cases of tonsillitis for no bacteriological work is done outside of Nairobi. We have already noted the apparent rarity of the streptococcus in Africa, but work still needs to be done on the identity of the organisms which cause tonsillitis in the African.

AGE	MALE	FEMALE	TOTAL
1-4	2	3	5
5-14	20	22	42
15-24	17	43	60
25-34	7	10	17
35-44	3	2	5
45-54	0	1	1
TOTAL	49	81	130

Table LXXI. The age and sex incidence of acute tonsillitis.

Peritonsillar abscess(511):

Twenty-six patients suffered from this complication of acute tonsillitis. There was no special annual incidence, but half the cases occurred in the long dry season which may or may not be significant. There was a slight preponderance of females for fifteen out of the twenty-six were of this sex, but this preponderance was not so great as in the series of cases of acute tonsillitis(See Table LXXI above). The majority of the cases were in the age group 5-34 years.

Upper respiratory infections(475):

There were three hundred and eighty-seven cases in this category in our series. They included cases of acute bronchitis for this disease was not always clearly distinguished from the other types of upper respiratory infection in the case notes. Common colds are not uncommon in South Nyeri District, but Europeans may serve for a whole four-year tour without suffering from one.

The annual incidence of our cases is given in Figure 64 along with the mean annual temperature to which it appears to show a direct relationship.

The monthly incidence is given in Figure 65 where it is compared with the mean monthly rainfall to which it appears to bear an inverse relationship. The correlation is not completely definite, but it does suggest that upper respiratory infections are commonest in the driest months when the winds are laden with dust which dries and irritates the nasal mucosa.

Figure 66 gives the sex and age incidence of the series. Males are affected twice as often as females, and most cases occur in the age group 1-34 years.

The pneumonias:

We saw in Table LXX that the pneumonias form the majority of the respiratory diseases of our series. Bronchopneumonia was almost twice as commonly diagnosed as the lobar variety. No case of atypical pneumonia was

FIGURE 64: Annual incidence of upper respiratory infections seen at Tumutumu compared with the mean annual temperature.

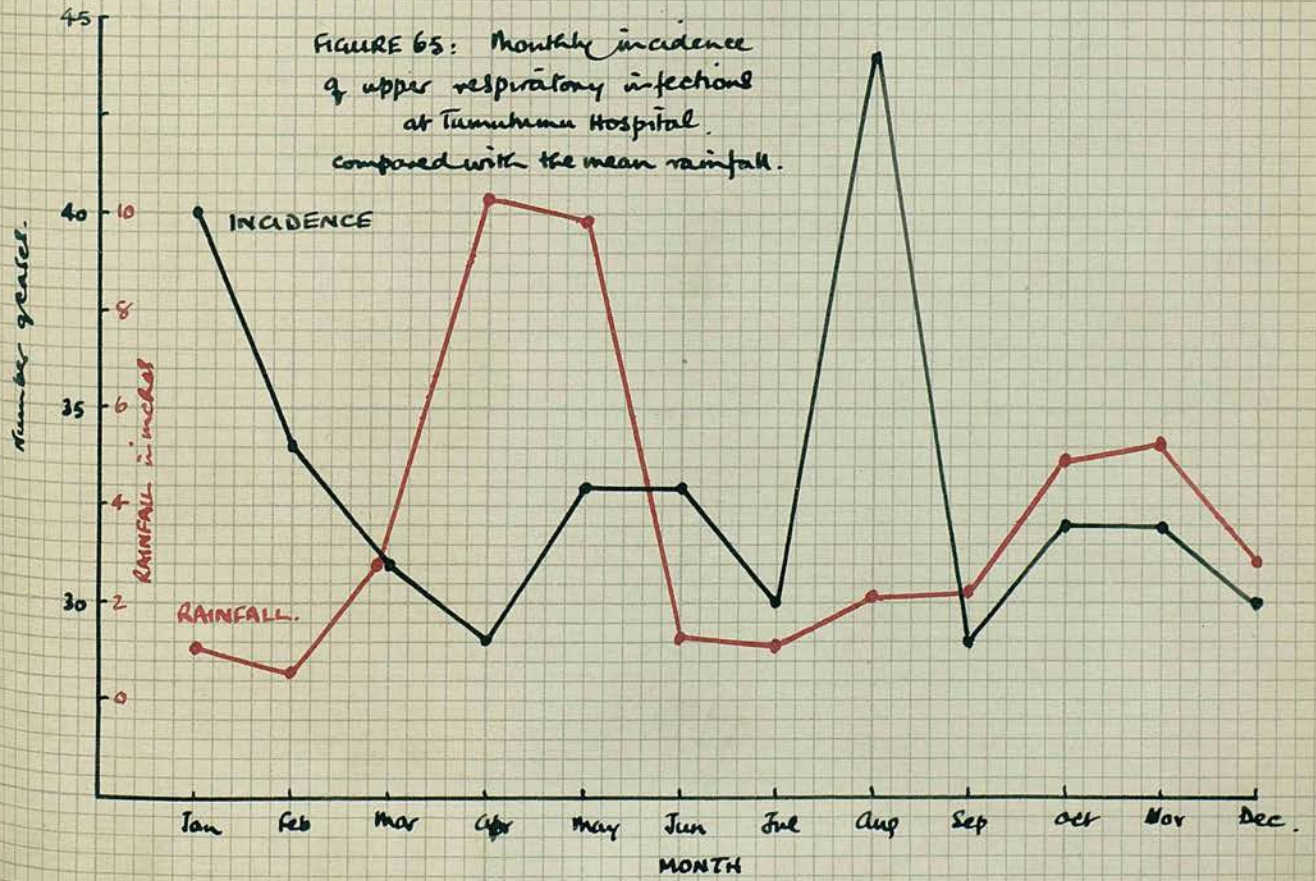


FIGURE 65: Monthly incidence of upper respiratory infections at Tumutumu Hospital compared with the mean rainfall.

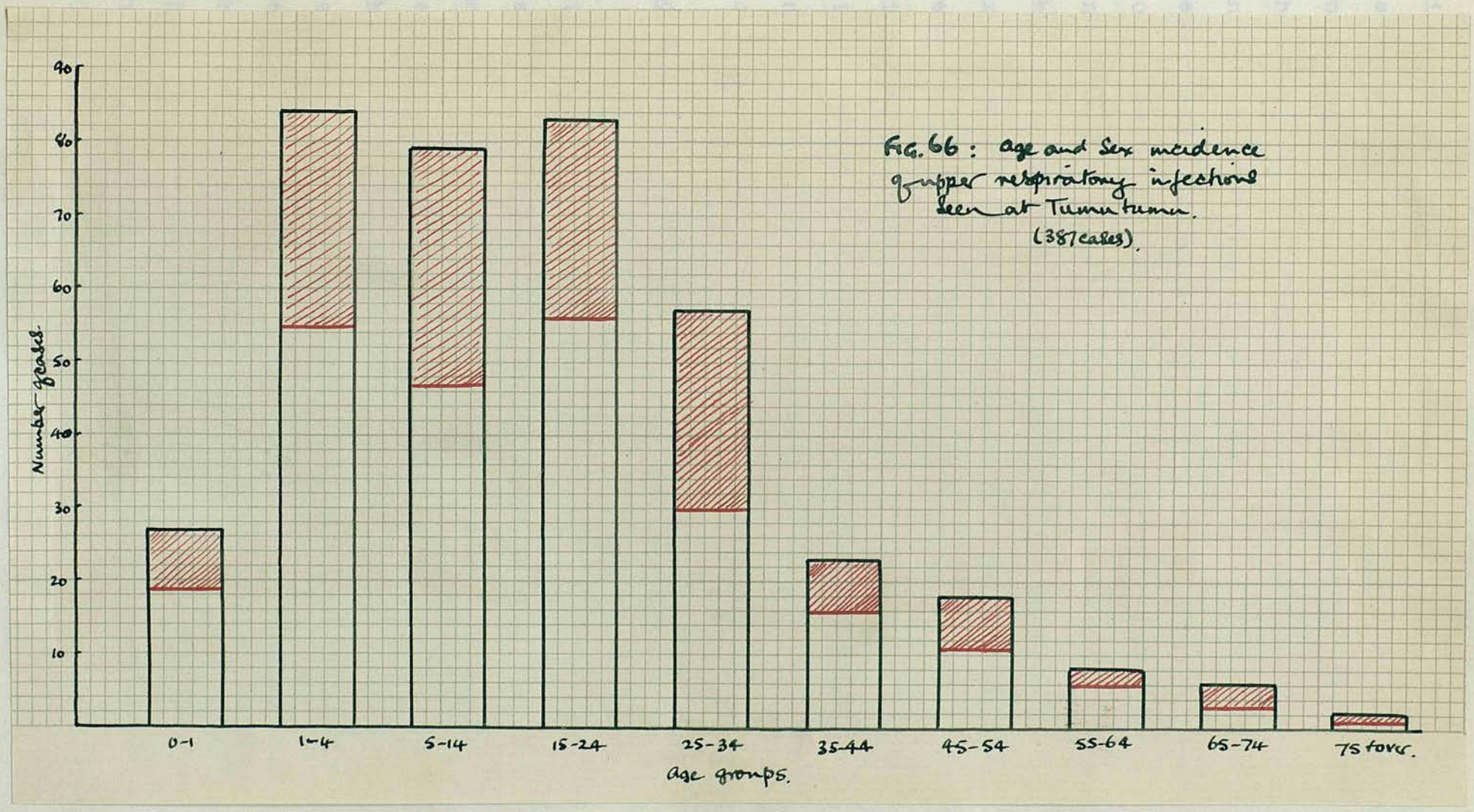


Fig. 66 : age and sex incidence of upper respiratory infections seen at Tumutumu. (387 cases).

diagnosed in the present series. There were, however, cases in which the classical signs of lobar and broncho-pneumonia were minimal and it is possible that some of these were due to viruses. We saw earlier how Q fever antibodies have been found in the blood of Kikuyu adults detained for Mau Mau offences, and so it is likely that some cases of pneumonia are in fact due to this type of infection. Hutton(1951) in his presidential address to the Uganda branch of the British Medical Association expressed the opinion that atypical pneumonia had become very prevalent in Uganda of recent years. He had first diagnosed a case in 1948. As facilities for more exact diagnosis become greater, the incidence of atypical pneumonia may be found to be more marked than it appears to be at present.

Lobar pneumonia(490):

There were five hundred and sixty cases of this disease in our series. The annual incidence of these cases is given in Figure 67 and is correlated with the mean annual temperature and rainfall. The relationship is an anomalous one. For the first half of the decade the incidence is most closely related to the mean temperature, whilst for the second half the closer relationship is with the mean annual rainfall. It should be noted, however, that apart from the year 1947 the incidence more closely follows the mean rainfall. Figure 68 gives the seasonal incidence and here the closest correlation is with the mean monthly temperature

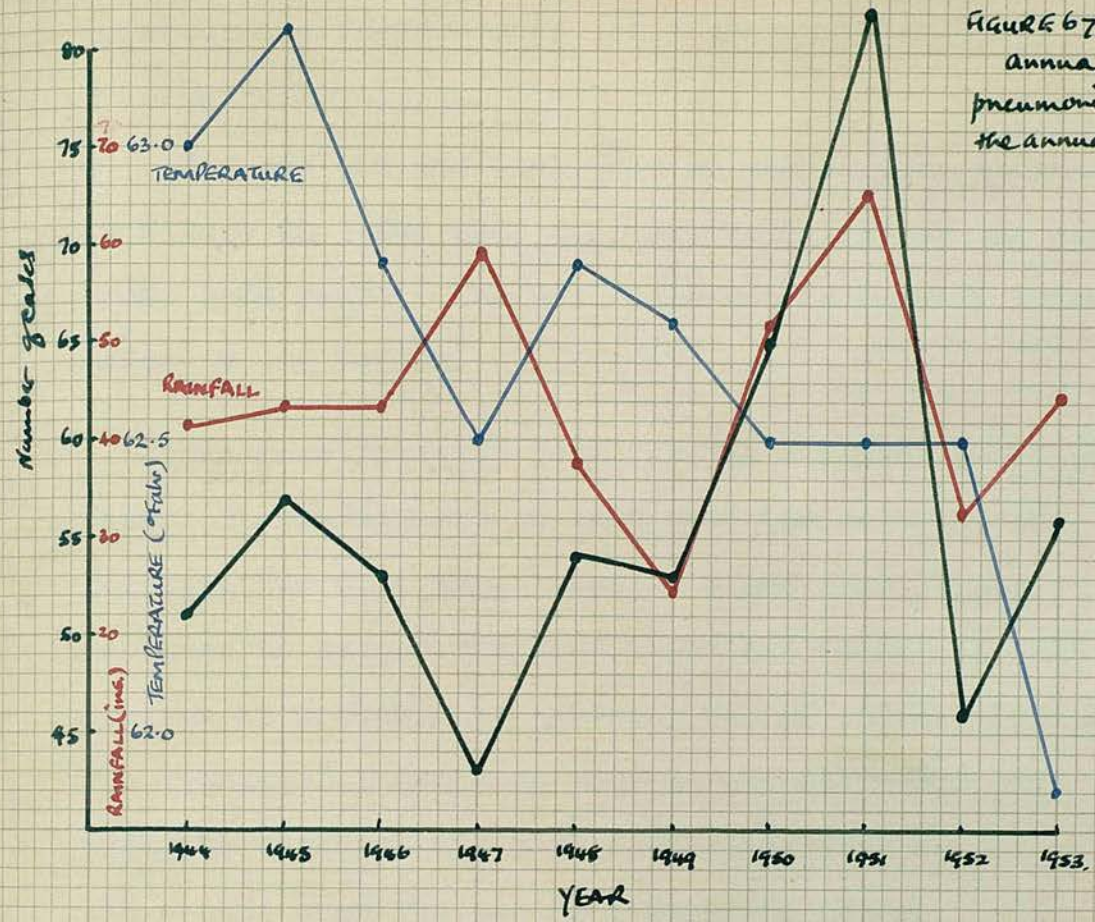


FIGURE 67: annual incidence of lobar pneumonia compared with the annual temperature and rainfall.

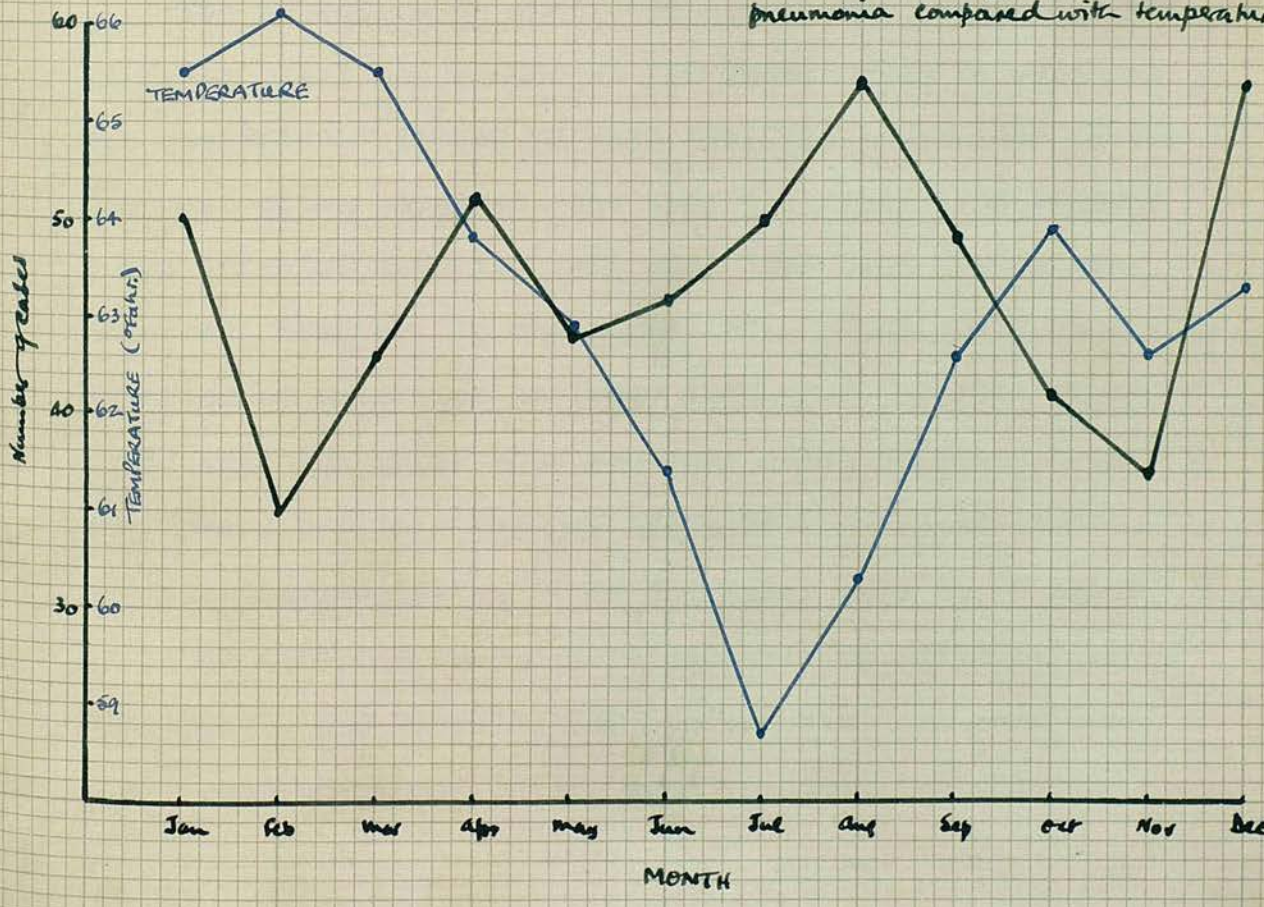


FIGURE 68: Monthly incidence of lobar pneumonia compared with temperature.

to which the incidence of lobar pneumonia shows an inverse relationship.

The age and sex incidence of the disease is shown in Figure 69. The main age incidence lies in the age group 5-34 years. The sex incidence is roughly three males to one female.

The case fatality rate for the disease is 6.4 per cent. It was highest in 1949 when the rainfall and relative humidity were lowest. Since then it has declined to zero. The most important factor in this decline is probably the greater use of antibiotics in its treatment. Twice as many males as females died from the disease, and most deaths occurred in the age groups over the age of fifty-five years.

The situation of the infection in the lungs is given in Table LXXII and Figure 70 for those cases in which it was specified. It can be seen that the lower lobe is the one most often involved, and that the right lung is more often affected than the left one. The lobe most often affected, however, is the lower left. Vint(1937) reported a series of autopsies on lobar pneumonia cases in which he found that the upper lobe was more often affected than the lower, but this has not been the finding in later series. Davies(1947a) found the lower lobe to be twice as often affected in Uganda Africans than the upper lobe. Vint(1937), and Trowell(1932) before him, had concluded that lobar pneumonia in Africans followed the pattern

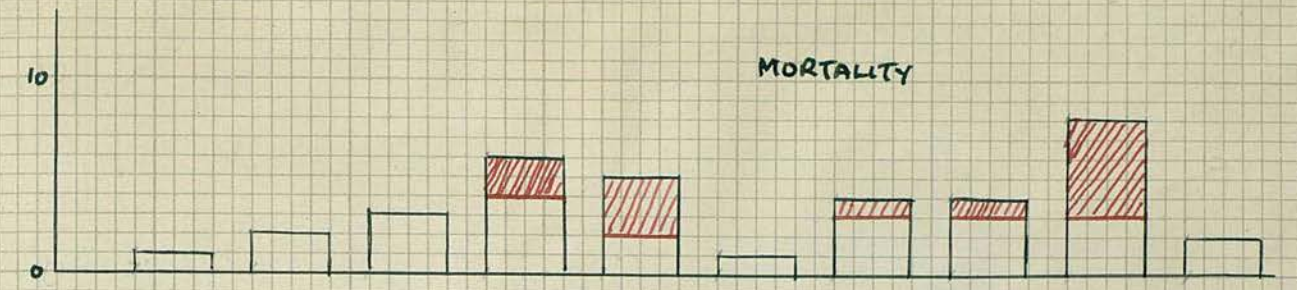
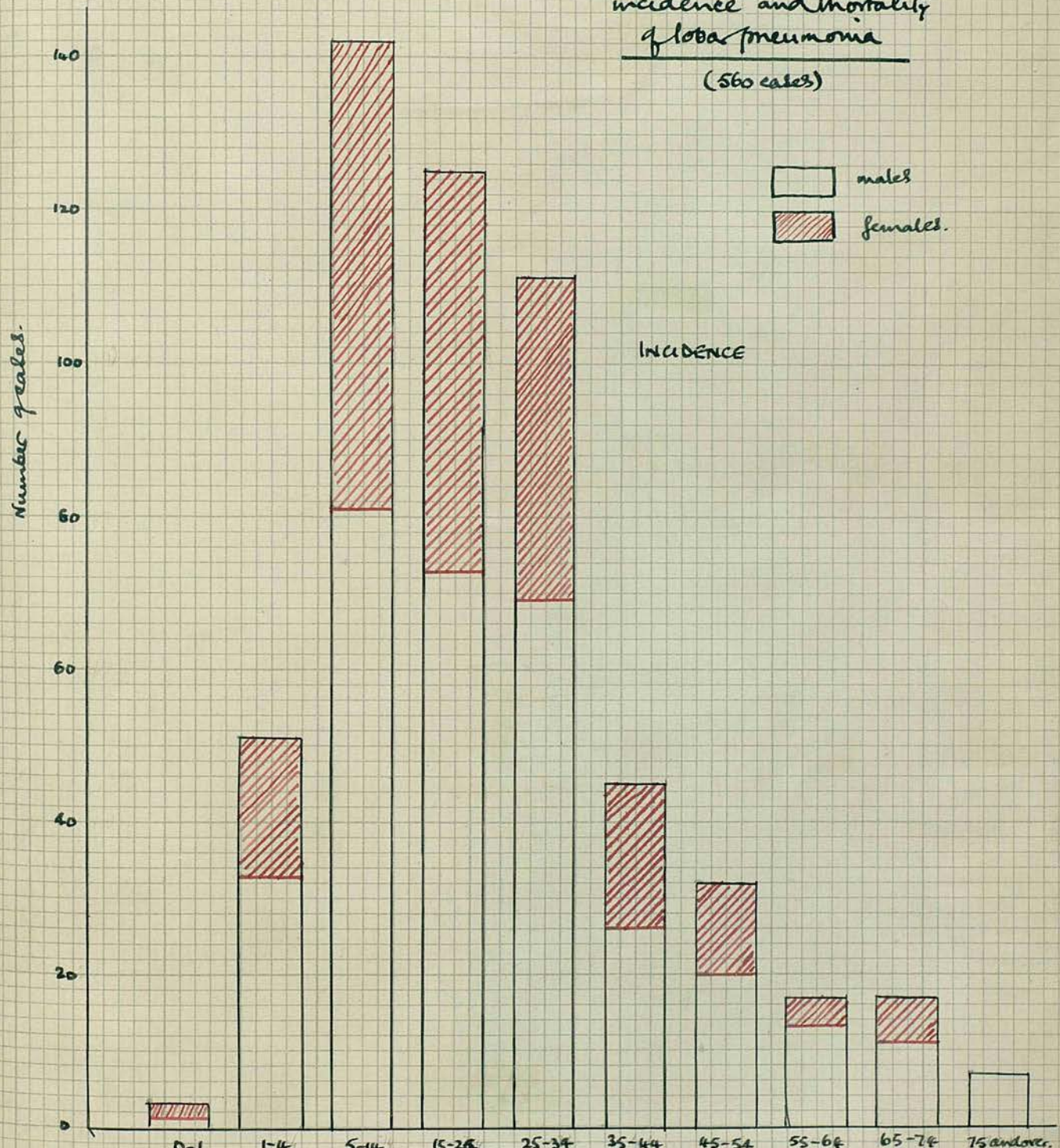


FIGURE 69: age and sex incidence and mortality of lobar pneumonia

(560 cases)



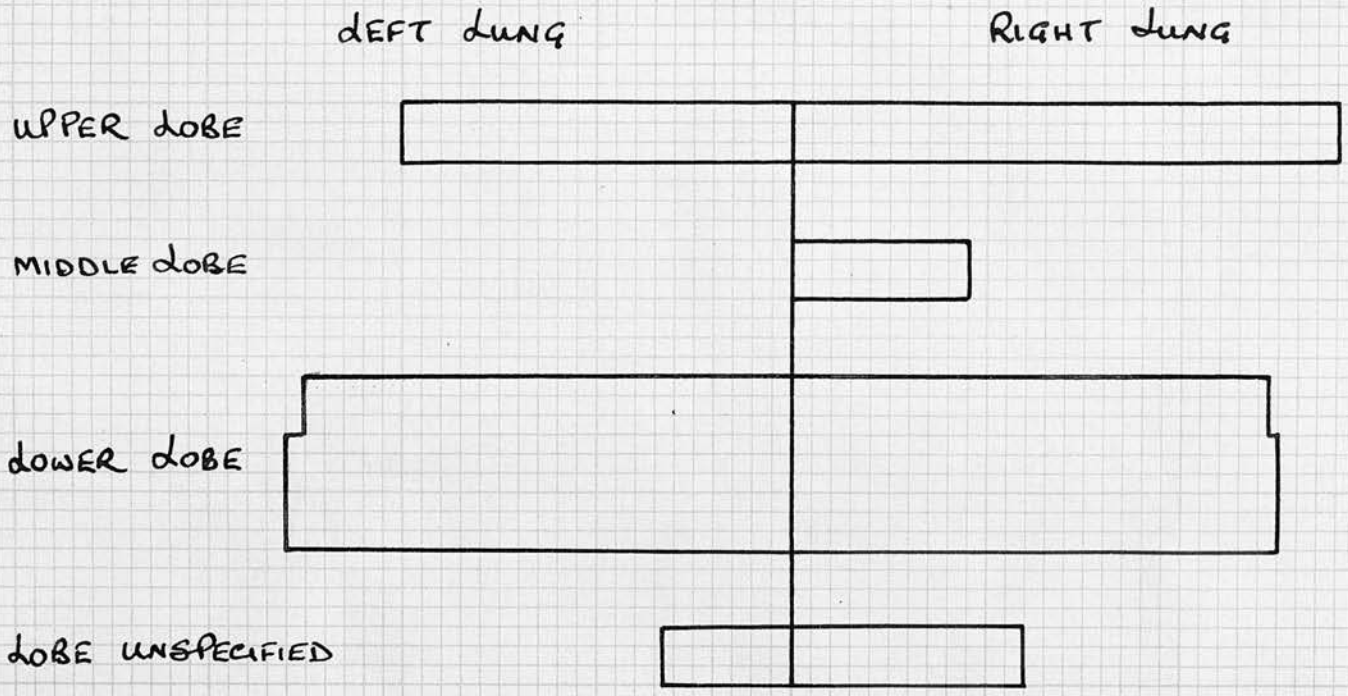


Figure 70: Analysis of lobar involvement found in 454 cases of lobar pneumonia.

found in European children even though it occurred in African adults. This pattern showed a high incidence of apical lobar pneumonia. Davies(1947a), however, did not agree with this for his figures resembled those found in adult cases in the United Kingdom and the United States. Our figures support Davies's view although they are not as clear cut as his.

LOBE	RIGHT LUNG	LEFT LUNG	TOTAL
Upper	56	40	96
Middle	18	--	18
Lower	149	154	303
Unspecified	24	13	37
TOTAL	247	207	454

Table LXXII. Distribution of lobar involvement in 454 cases of lobar pneumonia.

Trowell(1932) noted two clinical features of lobar pneumonia as he saw it in African patients in Nairobi. The first was the common occurrence of a frankly haemorrhagic sputum in these cases. This was seen in eighty-six per cent. of his series of one hundred and ninety-four cases. This has not been our experience. We have seen the classical rusty sputum on many occasions but only rarely could it be called frankly haemorrhagic. The second feature was the not uncommon appearance of jaundice in lobar pneumonia. It was seen in twenty-five per cent. of his cases. Gelfand(1947a) also mentions this

as an important sign in the African, and one which may appear early and be very intense. It is believed to be the result of earlier liver damage due to chronic protein malnutrition. A later infection such as that of lobar pneumonia may further damage the liver and produce a toxic jaundice. The appearance of jaundice in these cases was not noted on any of the case records of our cases.

Few complications were recorded as following lobar pneumonia. We have already referred to the case of acute pericarditis which followed lobar pneumonia in a girl of twenty-eight and from which she recovered. There are three cases of empyema in this series and it is probable that they followed an attack of lobar pneumonia since they cleared up with aspiration or surgical drainage, but no reliable history was obtained from them.

Bronchopneumonia(491):

Acute bronchopneumonia was the commonest respiratory disease in our series. It accounted for 3.4 per cent. of all inpatient discharges during the ten years of this study. It is also the respiratory disease with the highest case fatality rate. In many cases it complicated another disease, but in many cases this primary disease was not mentioned by the patient. In some cases it was and these cases are analysed in Table LXXIII. Bronchopneumonia is the common cause of death in the specific infections of childhood.

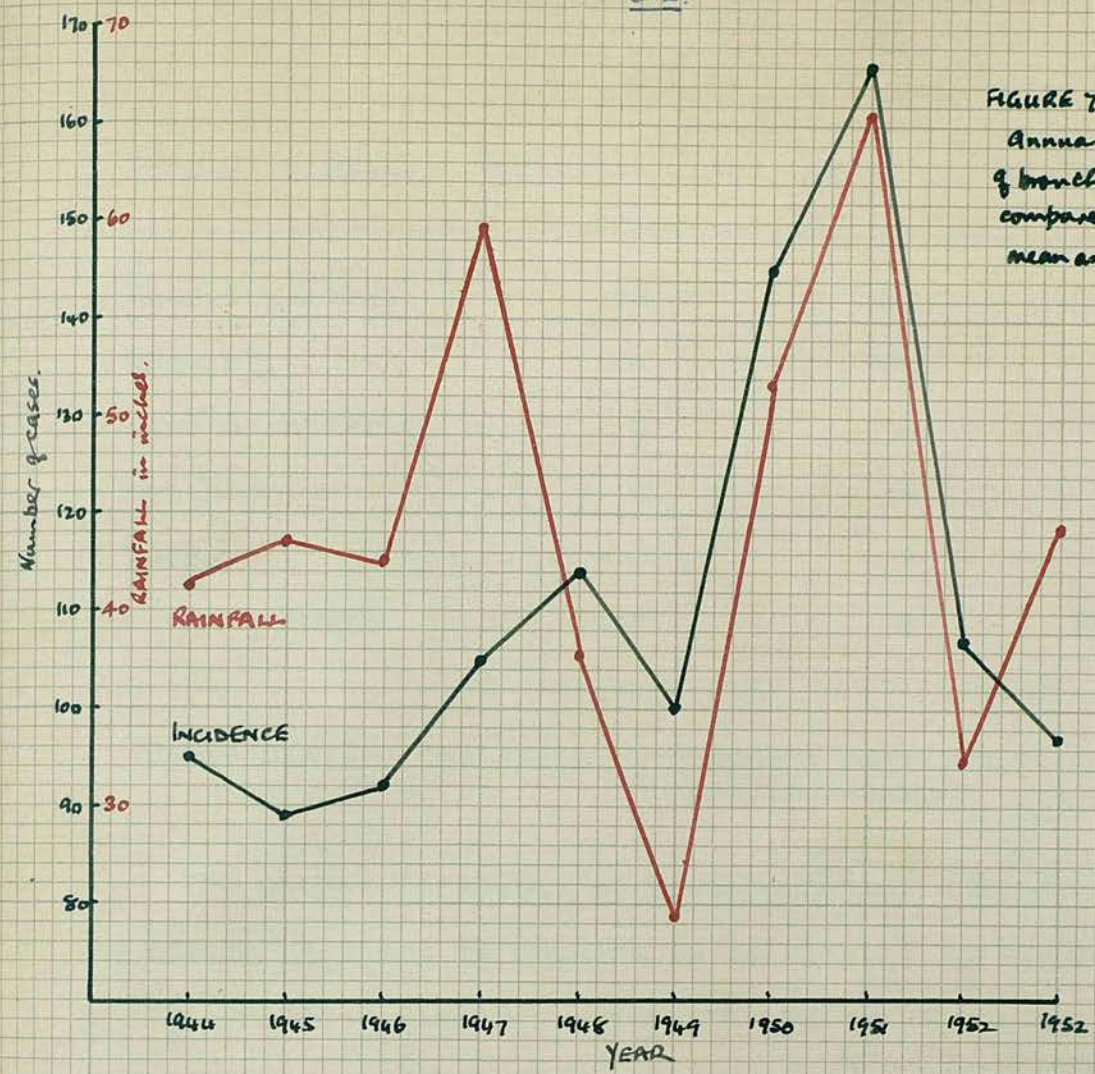


FIGURE 71:
Annual incidence of bronchopneumonia compared with the mean annual rainfall

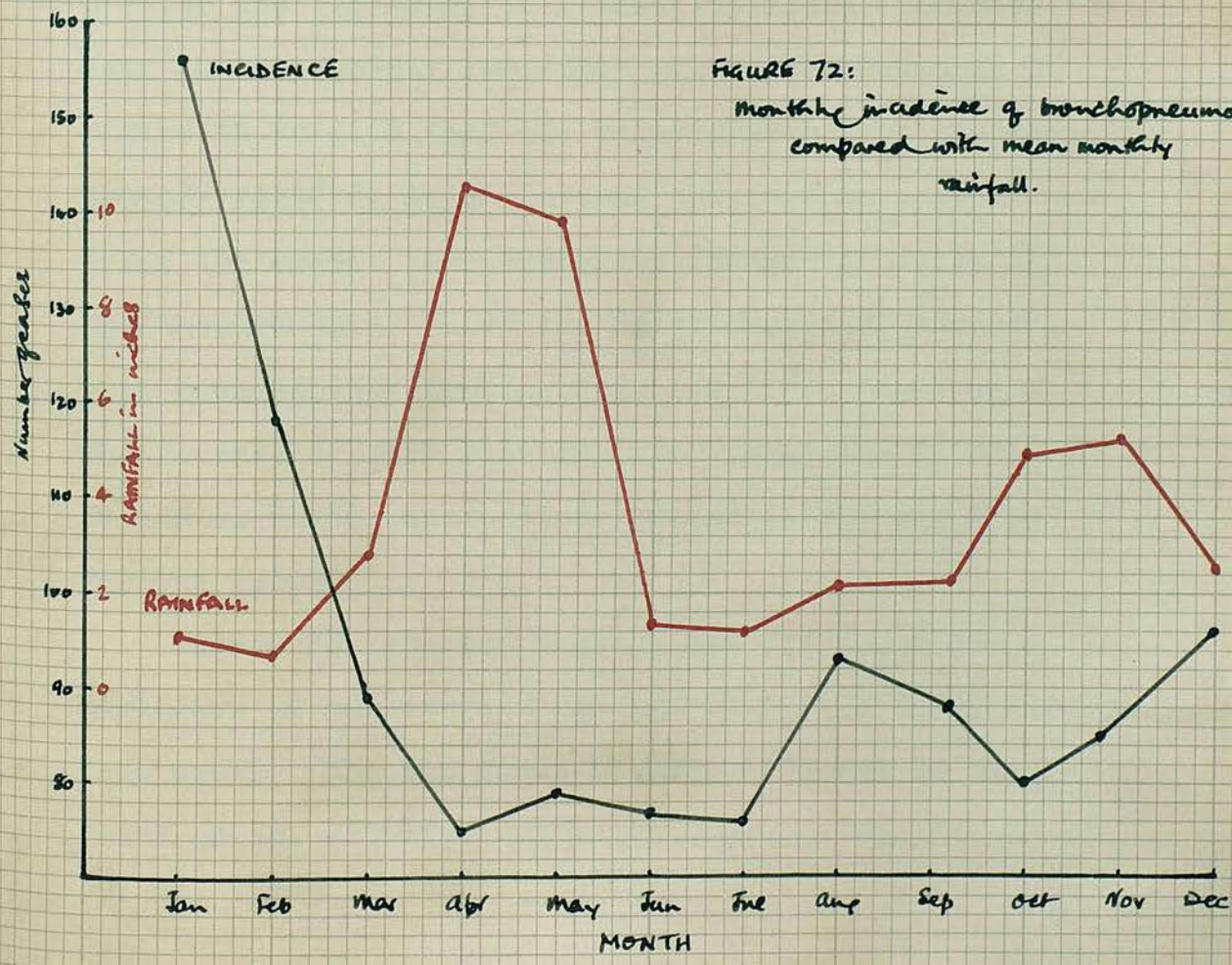


FIGURE 72:
Monthly incidence of bronchopneumonia compared with mean monthly rainfall.

PRIMARY DISEASE	NON-FATAL CASES	FATAL CASES	TOTAL
Whooping cough	95	74	169
Measles	68	22	90
Gastro-enteritis	2	2	4
Kwashiorkor	4	12	16
Burns	0	1	1
TOTAL	167	99	280

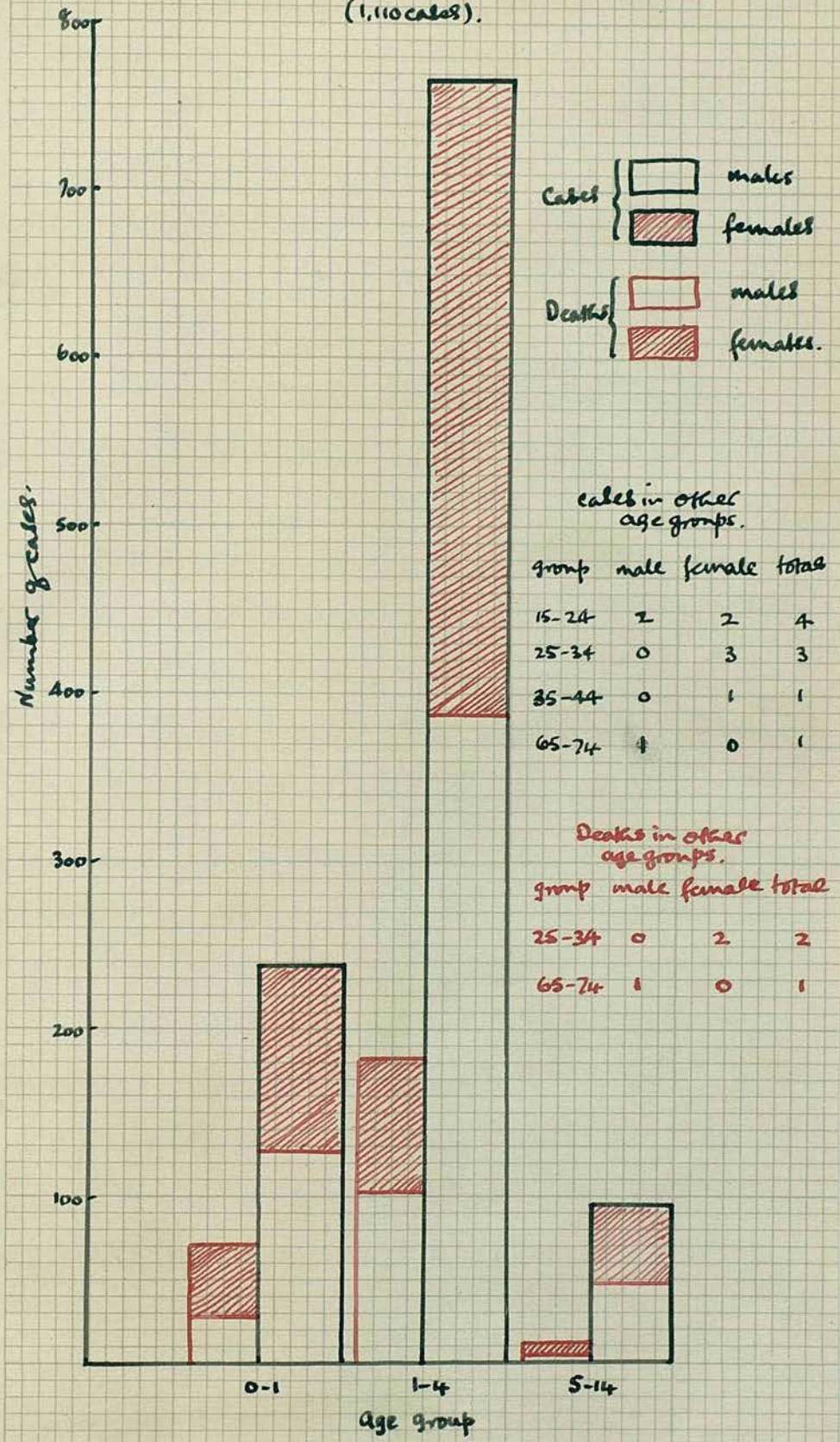
Table LXXIII. Analysis of diseases complicated by bronchopneumonia.

The annual incidence of bronchopneumonia is given in Figure 71 where it appears to be related to the mean annual rainfall directly. Thus the wetter the year the greater the incidence of bronchopneumonia. When we come to the monthly incidence of bronchopneumonia in Figure 72 we find that the relationship with the mean monthly rainfall is an inverse one, and in general the drier the month, the greater the number of cases of bronchopneumonia. Also the relationship of incidence with mean monthly temperature is a direct one, which is the reverse of that seen in lobar pneumonia in Figure 68 and is rather unexpected. We shall discuss this further below.

Figure 73 sets out the age and sex incidence and mortality of our cases. The sex incidence is more or less equal. The age group chiefly affected is the 1-4 years group, with the 0-1 years group as the next most

FIGURE 73: Age and Sex incidence and mortality of bronchopneumonia.

(1,110 cases).



Cases in other age groups.

group	male	female	total
15-24	2	2	4
25-34	0	3	3
35-44	0	1	1
65-74	1	0	1

Deaths in other age groups.

group	male	female	total
25-34	0	2	2
65-74	1	0	1

commonly affected.

The case fatality rate of bronchopneumonia in this series is twenty-four per cent. In our series at Tumutumu bronchopneumonia occupies second place to tuberculosis as a killing disease, but in the total figures for the South Nyeri District it occupies first place. In South Nyeri District it caused the death of a larger number of people during the decade of our study than did any other individual disease. The mortality shows no special annual or seasonal incidence of its own, but varies with the total number of the cases seen each year or month. The highest case fatality rate from the disease was seen in the age group 0-1 years where it was twenty-nine per cent. The greatest number of deaths, however, occurred in the age group 1-4 years where the case fatality rate was twenty-four per cent.

The influence of malnutrition in increasing the death rate from bronchopneumonia may per-haps be seen in Table LXXIII. In this table the highest proportion of fatal to non-fatal cases in any disease complicated by bronchopneumonia occurred in the kwashiorkor cases. Our figures are small but nevertheless suggest a trend which would probably be confirmed by collecting a larger series of cases.

The pneumonias and the rainfall:

If we add all the cases of pneumonia together for each year and plot them against the annual climatic data we find that they show an inverse relationship in the case of the mean annual temperature, and a direct relationship in the case of the mean rainfall and humidity. If the same procedure is carried out for the monthly figures we find that the relationships are reversed, and the relation to temperature is now direct and to rainfall and humidity, inverse. This is illustrated in Figures 74 and 75 where the rainfall values alone have been used to show the relationship for the sake of clarity.

The problem we have to solve is why is it that wet years have more cases of pneumonia than dry ones, whilst wet months have fewer cases than dry ones ? One possible source of error is that we are dealing with inpatient discharges and they do not exactly represent the incidence of the disease according to months. But pneumonia in these days is a short term disease and most cases are discharged within a week of admission, and so this source of error should not be very great.

There appears to be no obvious explanation unless it is that our figures are in fact unreliable, and we can only wait until more comprehensive figures for the district are available and see how far they confirm our present series. Meantime the anomaly must remain without any satisfactory explanation.

FIGURE 74. The annual incidence of pneumonia and the mean annual rainfall.

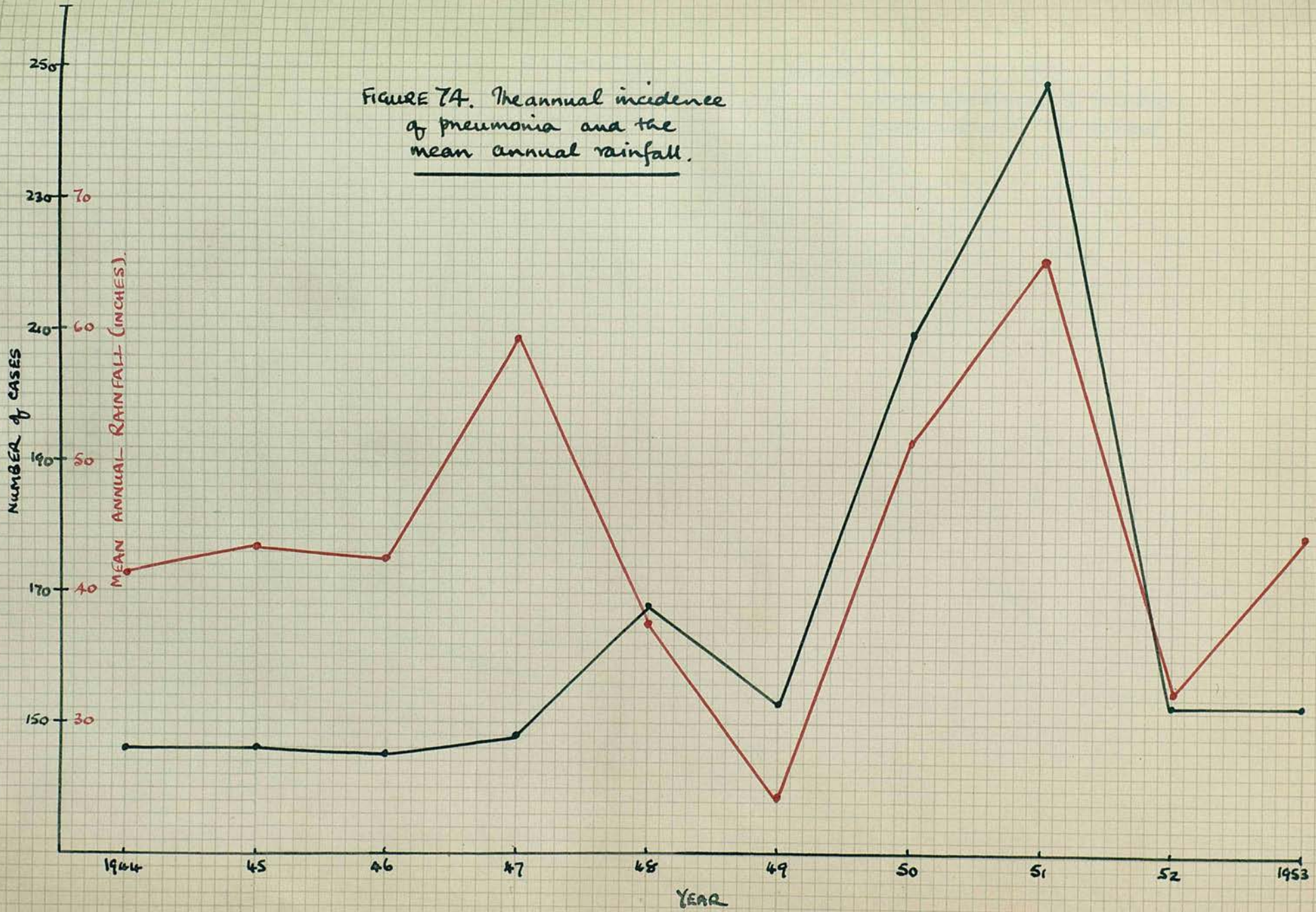
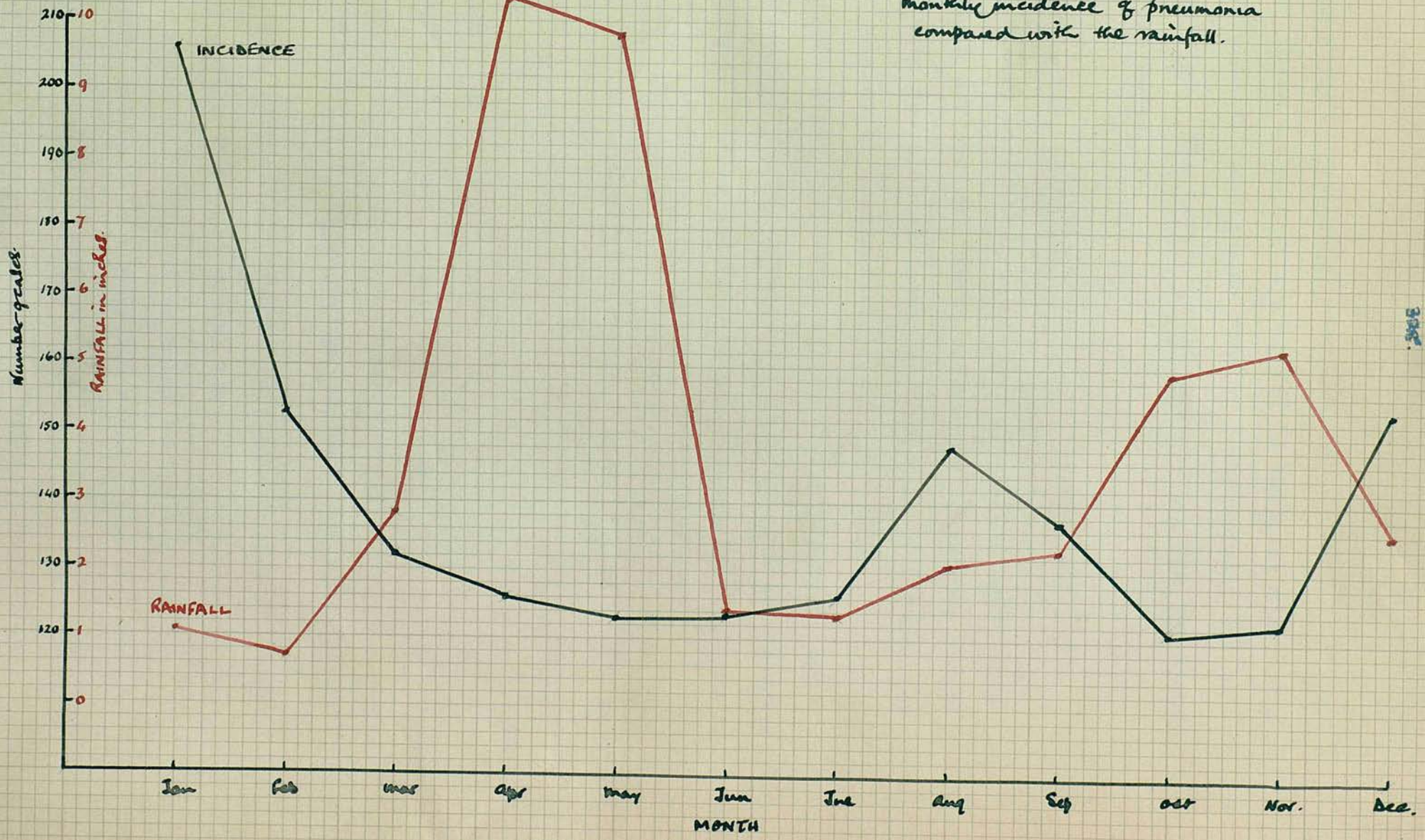


FIGURE 75:
Monthly incidence of pneumonia compared with the rainfall.



Respiratory obstruction(517):

Seven infants were admitted to hospital with difficulty in breathing due to some form of obstruction. Six of them died. The nature of the obstruction was not stated in the notes.

Empyema(518) and pleurisy(519):

There were thirty-six cases classified under this head in our series. Three were cases of empyema which may have complicated pneumonia in a male of fifteen and two females of twenty-five.

The other cases were twenty of dry pleurisy, and thirteen of pleural effusion. Their age and sex incidence is given in Table LXXIV. It is probable that most of

	1-4	5-14	15-24	25-34	35-44	45-54	OVER 75	TOTAL
MALE	1	4	5	6	4	1	1	22
FEMALE	0	2	4	4	1	0	0	11
TOTAL	1	6	9	10	5	1	1	33

Table LXXIV. Age and sex incidence of pleurisy.

the cases of pleural effusion were tuberculous in origin, and possible that most of the pleural irritation in the other cases was too, but as x-ray examination was not possible and Mantoux conversion studies were not done, it is impossible to confirm this.

IX. DISEASES OF THE DIGESTIVE SYSTEM:

One of the most striking features of the disorders of the digestive system is the contrast between their incidence amongst outpatients as compared with that amongst inpatients. They form the largest section of complaints amongst outpatients comprising twenty per cent. of the total outpatient complaints(See Table XL). Amongst inpatient discharges they comprise 2.8 per cent. of which acute gastro-enteritis make up 2.2 per cent. leaving 0.6 per cent, for other digestive disorders.

Diseases of the buccal cavity:

These are principally outpatient disorders and our inpatient total gives no accurate picture of their incidence in the community. The common European conception of the splendid teeth of the African is by no means true of the Kikuyu people. Dental caries is not uncommon, and pyorrhoea alveolaris is very common, especially in the later age groups. Oral thrush is common in infants, and the mothers do not appear to regard it as a disease.

Ulcer of stomach(540) and duodenum(541):

Formerly it was believed that peptic ulceration was very very rare in the African, but to-day it is being increasingly seen and diagnosed especially where x-ray facilities are available. There were three cases in our series and there is no doubt of the diagnosis in any of them. The gastric ulcer was demonstrated by x-ray examination in Nairobi, and the other two were duodenal ulcers which perforated and were found at laparotomy.

The gastric ulcer was in a male of thirty-six years old, and the duodenal ulcers in a female of fifty and a male of thirty-eight years. All were Kikuyu living in their own home environment and with no special worries or anxiety. It is probable that there were other cases of peptic ulceration in this series but which were missed. There are ten cases of haematemesis which are included under Section XVI of the Classification(see Table XLI), and it is possible that these were cases of peptic ulceration too.

Robinson(1935) states categorically that "the Negro and lesser pigmented races are immune(to peptic ulcer); the white race alone is susceptible." But we can no longer hold that view for there is no doubt at all now that peptic ulceration does occur in the African. We are not yet able to give a true estimate of its incidence for the available figures are chiefly derived from operation and autopsy experience. The latest East African figures are given by Raper(1954) from Kampala. He found forty-five cases of peptic ulcer in a series of two hundred and seventy-six autopsies, an incidence of 16.3 per cent. In only four of these cases had an ulcer been diagnosed before death. The incidence was greater in males, and duodenal ulcer was the predominant type found. Raper concludes that the incidence he found in Africans at Kampala "is certainly not less than that recorded in necropsy series in more civilised countries." Whether such a high incidence obtains in other parts of Africa remains to be demonstrated. The

impression is strong, however, amongst workers in Africa that with the increasing urbanisation and Europeanisation of the African, the incidence of peptic ulceration is rising. This may be due, of course, to increasing facilities for reporting sick and for diagnosis which result from the development of African medicine, but it is difficult to discount the factor of the stress of modern civilisation as it falls on individuals who are emerging from a primitive and self-contained society to take their place in a wider world. The occurrence of peptic ulcer and the other so-called diseases of civilisation such as hypertension, is the price the African has to pay for his place in the stream of the modern world.

Appendicitis(550):

Another unsolved problem of African medicine is the incidence of appendicitis. The four cases diagnosed in this series were all described as appendicular abscesses. Two were found at operation, in females of sixteen and twenty-five; and two were diagnosed clinically and treated conservatively, in males of twenty and thirty-four years. These patients certainly had inflammatory masses in the right iliac fossa, but it would be unsafe to say dogmatically that they came from the appendix vermiformis, though it is probable that they did.

Abdominal emergencies in the African:

There are not sufficient cases in our series, nor are their case records sufficiently detailed to allow a discussion of the acute abdominal conditions seen in the

Kikuyu. It may be of interest, therefore, to refer to a discussion by Burkitt(1952) in which he compared his experience of acute abdominal conditions in the Baganda and the English. He drew up a table giving the incidence of such conditions in three hundred consecutive cases amongst the Baganda. This table was as follows:

Strangulated hernia	219 cases
Intestinal volvulus	29
Band obstruction	21
Intussusception	11
Ruptured spleen	5
Acute appendicitis	4

In the discussion which followed this paper, Grattan of Nairobi said that inflammatory lesions were much commoner in the urban Africans of Nairobi than in Burkitt's series. The incidence of rupture of the spleen doubtless reflects a malarial endemic area. In general, however, Burkitt's experience would hold for most areas of East Africa although the relative incidence of the pathological conditions will vary from place to place.

One type of lesion which is not uncommon in the African patient is that due to weakness or laxity of the intestinal supports. Intestinal volvulus provides as good as an example as any amongst the acute conditions, and prolapse of the rectum amongst the more chronic ones.

The weakness of the supports may be the result of stretching under the weight of the intestinal contents due to the bulky diet of the average African. The site of the intestinal volvulus is commonly the pelvic colon in which accumulate the large bulky stools which result from the high residue diet the African eats.

Acute gastro-enteritis(571):

Acute gastro-enteritis is a disease of infants and young children. It is widespread in the tropics and is the commonest cause of admission to the children's ward of African hospitals(Jelliffe,1952). It is an infection which attacks the child because of the mother's ignorance and neglect of hygienic precautions. In some cases it complicates an already-existing disease and may result in a fatal outcome. In our series only very few cases were noted as complicating pre-existing diseases. These are analysed in Table LXXVI.

PRIMARY DISEASE	NON-FATAL CASES	FATAL CASES	TOTAL
Measles	3	8	11
Kwashiorkor	7	12	19
Whooping cough	3	4	7
TOTAL	13	24	37

Table LXXVI. Analysis of diseases complicated by acute gastro-enteritis.

FIGURE 76: Annual incidence of gastro-enteritis compared with the relative humidity.

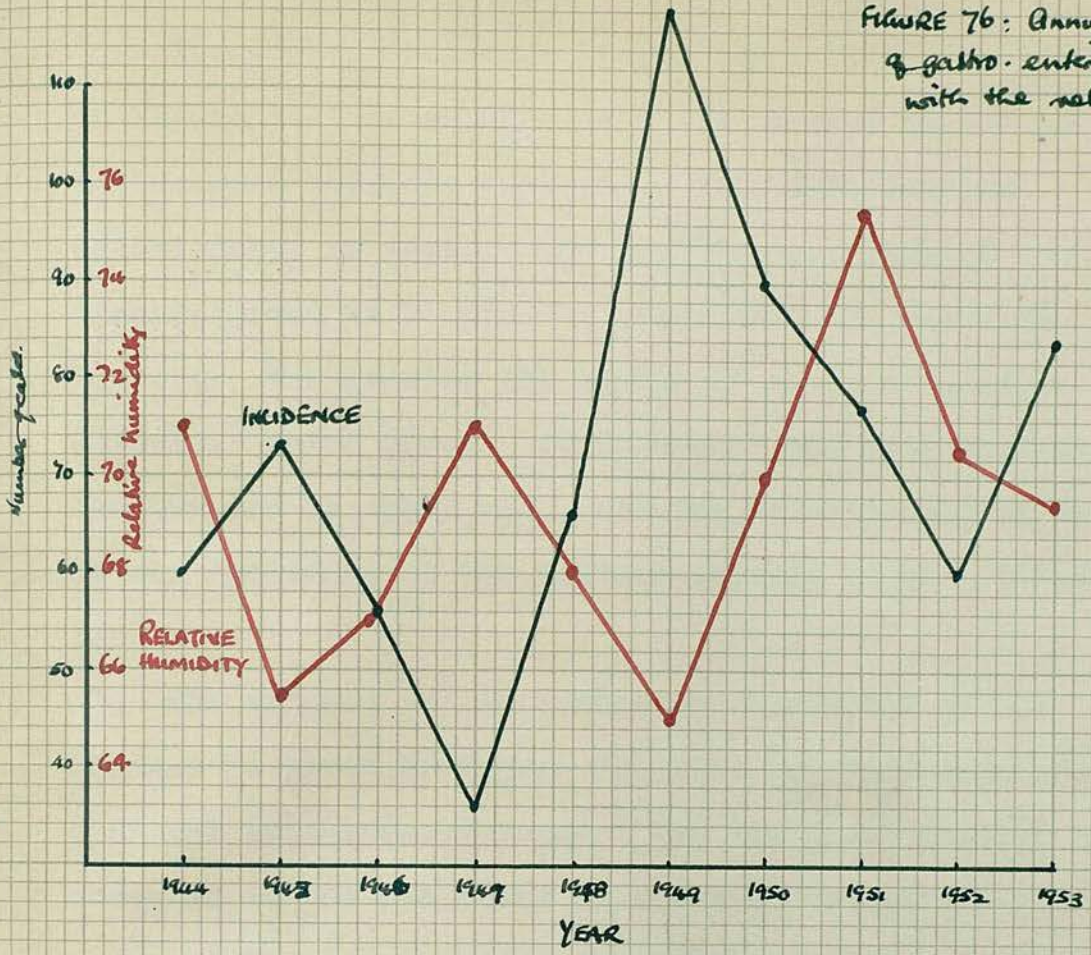
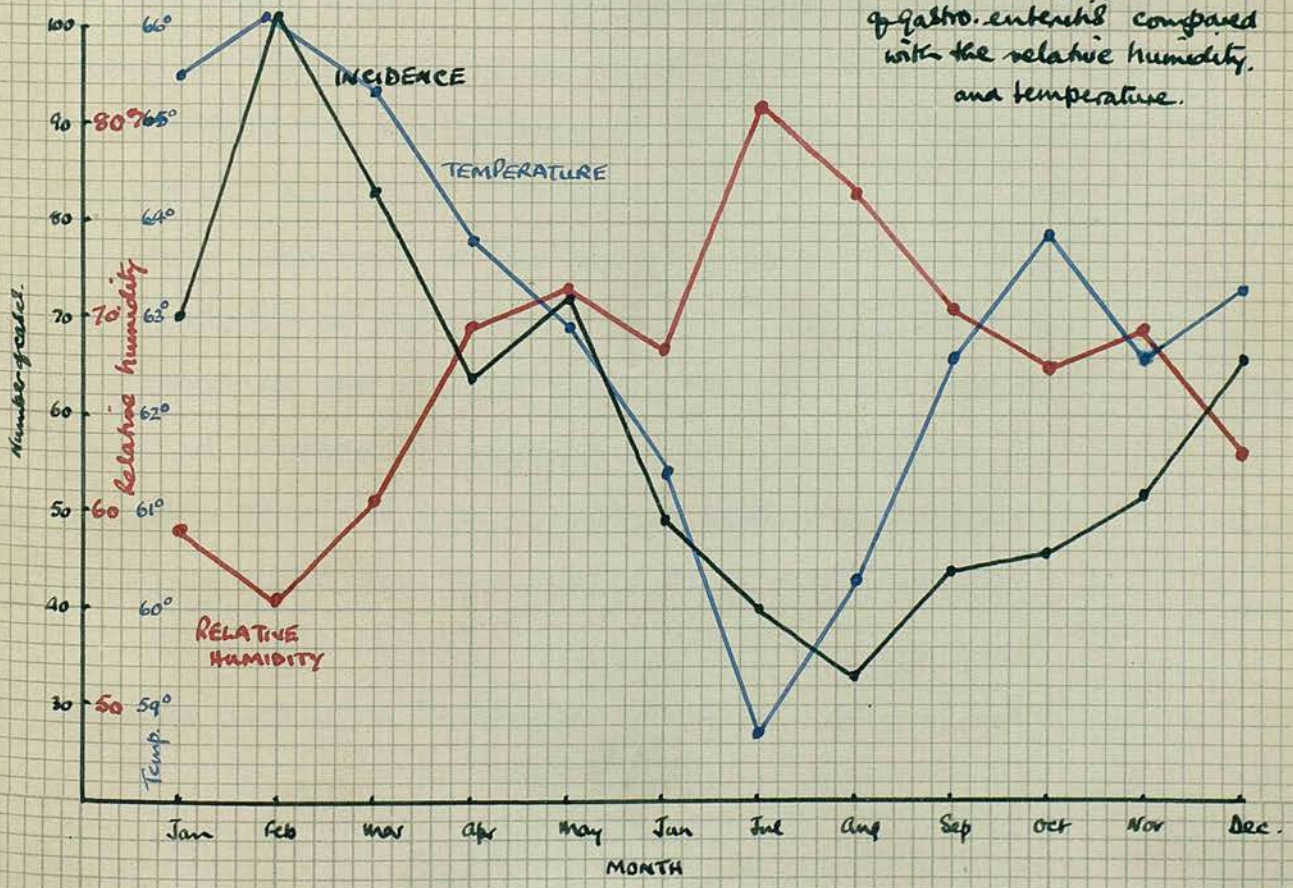


FIGURE 77: Monthly incidence of gastro-enteritis compared with the relative humidity and temperature.



The annual incidence of gastro-enteritis is shown in Figure 76. It shows a definite inverse relationship to the mean relative humidity. This same inverse relationship is seen in the monthly incidence of the disease given in Figure 77. The lower the relative humidity, the greater the number of cases of gastro-enteritis which occur. In Figure 77 the mean monthly temperature is shown also, and the relationship of this to the incidence of the disease appears to be a direct one.

The age and sex incidence and mortality of the disease is given in Figure 78. The sex incidence shows a slight male preponderance. The age group chiefly affected is the 1-4 years in which about sixty per cent. of the cases occurred. Eighty-eight per cent. of the cases occurred in the first five years of life which is the period during which the mother is responsible for the hygiene of the child and for its training. This high incidence thus reflects the low hygienic standards of the Kikuyu people and their lack of knowledge of the laws of health. During lactation and suckling the average Kikuyu mother would never think of washing her nipples before feeding her infant. With the slow spread of health propaganda it is to be hoped that the incidence of acute gastro-enteritis will decline, but it cannot be said to be showing much of a decline in the decade of our study.

FIGURE 78: age and sex incidence and mortality of GASTRO-ENTERITIS.
(720 cases)

It is impossible to obtain a true assessment of the incidence of acute gastro-enteritis from hospital figures for these refer only to those cases who were ill enough to need hospital treatment. For every case which was admitted to hospital for parenteral fluid therapy, there were others who were not ill enough to come to hospital, or who only needed outpatient care. The figures based on these cases are not available to us and are impossible to estimate.

The same observation applies to the figures of mortality. Amongst the inpatient discharges for gastro-enteritis there was a case fatality rate of thirty-three per cent., but this figure has meaning only in relation to the hospital population, and not in relation to the population of our area. On the basis of our hospital experience of the disease we may say that gastro-enteritis ranked second to bronchopneumonia as a killing disease amongst our hospital admissions during the first five years of life.

Diseases of the liver and gall-bladder:

We have already discussed infectious hepatitis and primary carcinoma of the liver in previous sections. In this section we have eighteen cases of cirrhosis of the liver(581). Eight of them were males and ten were females, and their ages ranged from sixteen to sixty. Eight patients died: five were females and three were males, whose ages ranged from twenty-six to fifty-five years. In view of the recently recognised relationship between chronic protein malnutrition and a damaged state

of the liver, it is surprising to find so few cases of hepatic cirrhosis amongst a people whose diet is deficient in protein. Our experience is confirmed, however, by the observations of Dr F.J.Wright late of Nairobi, which were quoted by Brock and Autret(1952). Wright found that though kwashiorkor was common amongst the Kikuyu, cirrhosis and primary carcinoma of the liver were less common. Amongst the Kamba people whose reserve adjoins the Kikuyu country, on the other hand, kwashiorkor was rare, but cirrhosis and primary carcinoma of the liver were more common. These observations are difficult to explain on our present knowledge. We need to have much more information about the pathology of liver disease amongst the Kikuyu than we possess at present.

Cholelithiasis(584) is represented by a single case of biliary colic. Lewis(1942) notes that American negroes show a much lower incidence of gallstones than white patients do, and this appears to hold true for Africans too. Gallstones do occur in the African, but they are rare. Outside the present series we have seen three undoubted cases, one of which was found at operation to have a single gallstone impacted in the cystic duct. It is difficult to understand why gallstones should be so uncommon. Infection of the gall-bladder appears to be very rare. It is possible that the low incidence of stone is associated with the low fat intake, but no studies have been made on serum cholesterol or on the composition of gallstones in the Kikuyu.

X. DISEASES OF THE GENITO-URINARY SYSTEM:

The diseases of the genito-urinary system seen in this series are broadly classified in Table LXXVII.

DISEASE	NUMBER
URINARY	20
GENITAL, MALE	7
GENITAL, FEMALE	736
TOTAL	763

Table LXXVII. Genito-urinary disease seen at Tumutumu Hospital during period 1944-53.

The urinary diseases were all infections, either nephritis or pyelonephritis. The male genital disorders were all due to prostatic enlargement. The preponderance of disorders of the female genital tract is very striking. The majority of these disorders was composed of the following three conditions:

Female sterility	473 cases
Genital infection	78 cases
Acquired vaginal atresia	66 cases

The first and the last of these disorders acquires a special significance amongst the Kikuyu people which will be commented on in the appropriate subsection below.

Acute nephritis(590):

In view of the statement of Manson-Bahr(1954) that "acute nephritis is commonly encountered" in the tropics, it is rather surprising that there are only twelve cases of this disease in our series which is made up of all inpatients seen over a period of ten years. So far as the Kikuyu are concerned, the disease appears to be uncommon. We would expect this if it is in fact due in some way to streptococcal infection, for we have already noted the absence of the streptococcus from African pathology. Just as we see the occasional case of rheumatic fever amongst the Kikuyu, so we see one of acute nephritis, and both are related to streptococcal infection.

Most of the articles published on nephritis in East Africa have come from Uganda. The first on this disease was published by Hennessey(1939) and he was impressed by the frequency of glomerular lesions in his cases. Then in 1949 Davies published a post-mortem study of renal disease from Kampala. He found three hundred and one cases of nephritis amongst the post-mortem records there, but only twenty-eight could be classified as glomerulotubular nephritis. He found obstructive lesions of the urinary tract secondary to urethral stricture to be very common. We have already seen how urethral stricture appears to be more common in Uganda than it is in Kenya, although it is difficult to understand why this should be so. In 1953 Raper studied the cases of renal disease which had come to post-mortem examination in the previous five years. He found one hundred and thirty-six cases

amongst about two thousand eight hundred cases, an incidence of about five per cent. He came to the conclusion that in general the various forms of renal disease seen in Uganda are closely comparable to those seen in Britain, except for a special type of renal amyloidosis which he describes for the first time.

Our series contains twelve cases of acute nephritis, eight of whom were females. In two females of twenty and twenty-eight, the condition appeared to follow pregnancy, and in one of these it was fatal. Eight of the cases were in the 5-24 years age group. The disease was fatal in six of the cases, four of whom were females. The diagnosis was entirely clinical in these cases, and unfortunately no post-mortem examinations appeared to have been done on the fatal ones.

Chronic nephritis(592):

The three cases of chronic nephritis were in males aged fifty-one, sixty, and sixty-eight.

Infections of the kidney(600):

There were five cases of acute pyelo-nephritis, three of whom were females aged eighteen, twenty-three and twenty-five, and two males aged thirty-five and forty. It is surprising that there were so few urinary infections in our series. No cases of cystitis were diagnosed amongst inpatients.

Hyperplasia of the prostate(610):

Almost every patient in whom this condition was diagnosed was admitted to hospital with acute retention of urine. They endure the difficulty of micturition until finally they are unable to pass urine and then they seek medical aid for their condition. Thus of the seven cases in this series, six were admitted with acute urinary retention, whilst the seventh was brought in a state of uraemic pre-coma. Their ages ranged from forty to eighty years of age. Three of them died in uraemia.

It is impossible to estimate the incidence of enlargement of the prostate in the Kikuyu male for he only reports sick when he can stand the strain of urinary obstruction no longer, and therefore figures derived from hospital practice in Kikuyuland are not an accurate guide to its incidence. It is probable that the incidence is not so great as in European practice for the reason that the African male dies at an earlier age than that at which prostatic hypertrophy is most commonly seen in European males.

Diseases of the female genital organs:

The most common and the most important gynaecological symptom in the African woman is sterility(636). In Africa as amongst most primitive people,barrenness is a source of great shame and tragedy to a woman. It is not very surprising, therefore, to find that sixty-five per cent. of our gynaecological cases were complaining of this.

In most cases the cause cannot be found, but it is probable that many cases are due to infection, either gonococcal or tuberculous. It is impossible to assess in how many cases the male is at fault for the Kikuyu male mind has not yet accepted the fact of the existence of male sterility, for it is much more convenient and less humiliating to be able to blame the female.

The incidence of uterovaginal prolapse(631) is surprisingly low in view of the common incidence of infections and complications of labour. This may be related to early ambulation after delivery.

The vaginal atresia, of which there are sixty-six cases in our series, were all the result of female circumcision. Julian Huxley and L.S.B.Leakey have popularised the idea that this operation consists simply of a clitoridectomy, but in most cases the operation is much more extensive than this. The severity of the operation varies from place to place in Kikuyuland. It is most severe in the Fort Hall area and I have operated on cases from this area in which the vaginal opening was completely occluded except for a small opening posteriorly which would barely admit the tip of the little finger. In general it is true to say that the clitoris and labia minora are removed and the wound heals up with the occlusion of the anterior half of the vaginal introitus. The occluding scar tissue has to be incised longitudinally and then sutured transversely in order to repair the damage done by the first operation.

It is not difficult to imagine the problems which will arise for a girl with a severe vaginal atresia when she gets married. Normal sexual intercourse will be difficult, and in some cases impossible for her, and the possibility of conception will be correspondingly reduced. If she does become pregnant, and it is surprising how many do in spite of a severe degree of atresia, then she will have further difficulty at the time of her delivery. The tightly contracted soft tissues of the pelvic outlet will resist the descent of the foetal head until they and the perineal tissues are severely lacerated, and perhaps a vesico-vaginal fistula has been produced.

XI. DELIVERIES AND COMPLICATIONS:

This is not a study of Kikuyu midwifery, but a few remarks may be made on the type of case and complication seen amongst the Kikuyu people.

There are two sources of difficulty in childbirth for the Kikuyu woman. One is bony and results from the Kikuyu woman's method of carrying a heavy load. The other concerns the soft tissues and is the result of the female circumcision operation to which we referred above. The first source causes difficulty at the pelvic brim, and the second at the outlet during labour.

The Kikuyu woman ties up her load with a wide leather strap which she passes round her forehead from the load which rests on the lumbo-sacral area of the spine. As

she walks she leans forwards with her forehead in the strap, and pushes the load upwards and backwards with the lower part of the spine. As this method is adopted quite early in life by the girls who help their mothers to carry water and firewood, it results in an increase in the lumbo-sacral lordosis which makes the sacral promontory even more prominent and decreases the antero-posterior diameter of the pelvic brim. This leads to increased difficulty in the engagement of the foetal head and an increased incidence of rupture of the uterus. The Kikuyu women have never carried loads on their head and there is a good geographical reason for this. They have always lived in well-forested country where low branches of trees would soon knock loads off their heads. The result was that they developed this method of load-carrying which is ideally suited for carrying loads along narrow forest tracks under low branches.

The second source of difficulty in childbirth for the Kikuyu woman is the soft tissue scar which closes the anterior part of the vaginal opening as the result of the operation of female circumcision. It leads to delay in the second stage with increased risk to the foetus, and an increased possibility of the development of a vesico-vaginal fistula. Also it means that deep episiotomy is almost a routine procedure in a normal maternity case. Where this is not done severe perineal laceration commonly results.

It is the custom at Tumutumu Hospital for reasons

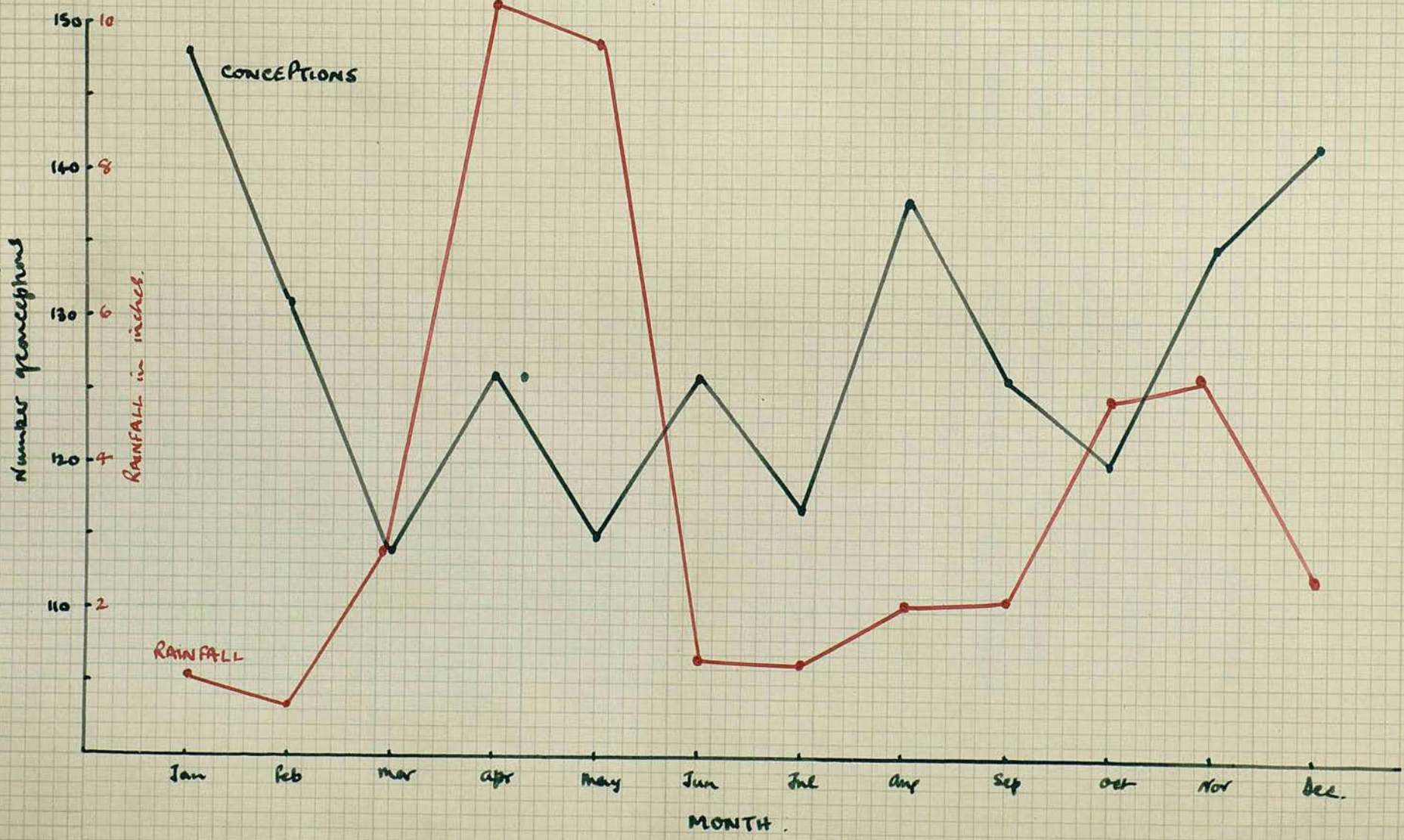
of economy to make only pencil notes on the maternity case sheets. These are then erased when the patient is discharged and the case sheet can then be used again. The result of this practice is the destruction of many valuable records which cannot be replaced. Thus it is impossible to give any detailed analysis of the maternity cases.

The monthly average number of births is available for both Tumutumu and Nyeri Hospitals are available and if we add these together we get the following figures for the avergge numbers of births in hospital each month:

JAN	126	JUL	120
FEB	115	AUG	135
MAR	126	SEP	142
APR	117	OCT	148
MAY	138	NOV	131
JUN	126	DEC	114

If we now advance these figures by nine months we get an approximate idea of the month of conception, and this is plotted in Figure 80. The months of the greatest number of conceptions are December and January in the short dry season. The mean monthly rainfall curve is also given in Figure 80 and there does appear to be an inverse relationship between the rainfall and the conception rate. If the relationship is significant it is a little difficult to suggest any explanation for it.

FIGURE 80: Conceptions compared with rainfall in South Nyeri District.



The average annual number of births in the two hospitals is 1,538. We have no number for the Consolata but we may safely reckon two thousand as the number of deliveries which occur in the three hospitals of South Nyeri District each year. We saw from Table X that the estimated birth rate was in the region of forty-five per thousand which would give an average annual number of births for South Nyeri District of about eight thousand. We may conclude then that only one in every four births takes place in the hospitals of the district.

XII. DISEASES OF THE SKIN & CELLULAR TISSUES:

According to Lewis(1942) the negro is more resistant to diseases of the skin than the white man. His skin is less protected by clothes from environmental influences and tends to be thicker and hornier. It is difficult to know whether this is so or not for African dermatology is still not well known and trained dermatologists working in Africa are few. Also most cases of skin disease are treated as outpatients, and often by African hospital assistants who have no special competence in the diagnosis of skin diseases. Only the more serious cases are admitted to hospital where they can be more adequately diagnosed, but the inpatient incidence of skin disorders will not give a true picture of those which occur in the community at large.

The bulk of the skin lesions seen in this series is made up of tropical ulcers, cellulitis and abscesses, and if we take these away from our series few cases of skin disease remain.

Loewenthal(1936) compiled a list of those skin diseases which are unknown or uncommon in African patients. His list is borne out by our own experience at Tumutumu, but any such list can only be temporary and incomplete because medical experience of skin lesions in Africa is still far from complete, and it is possible that some of the lesions he lists are not uncommon in some areas. His lists is as follows:

1. Photodermatitis,
2. Dermatitis due to external irritants,
3. Tuberculosis of the skin,
4. Impetigo contagiosa,
5. Boils and carbuncles,
6. Eczema,
7. Seborrhoeic dermatitis,
8. Acne vulgaris,
9. Psoriasis,
10. Rosacea,
11. Lupus erythematosus,
12. Rodent ulcer,
13. Prickly heat(lichen tropicus),
14. Alopecia areata,
15. Alopecia senilis, and
16. Pruritus in its various sites.

A few of these conditions are represented in our series, but the majority are not. Nevertheless it would be presumptuous to conclude that any of them never occur in the African until we have fuller information. It is true to say, however, that most are much less commonly seen in the African than in the European patient.

There are certain skin conditions which are more common in the African than they are in the European, and Loewenthal(1936) lists these as follows:

1. Fibroplastic diseases
2. Lichenification such as is seen in yaws.
3. Lichenoid diseases, e.g. the trichophytids,

4. Dermatosis papulosa nigra, and

5. Erythema ab igne.

The fibroplastic diseases include keloid formation in scars, ainhum, and possibly endomyocardial fibrosis and the marked fibrosis which produces the great thickening around ulcers of the skin. Keloid formation is the basis of a common form of tattooing amongst the Kikuyu. In young girls a circle of incisions is made around each breast before puberty and these heal with keloid formation and are regarded as a mark of beauty when the breasts develop. Another site where keloids may develop is in the lobes of the ears which have been pierced, dilated and stretched in order to receive the numerous ear ornaments in both male and female. It was two such keloids which led to the admission of the two patients noted in Table XLI. They were a male of twenty-five and a female of nineteen who came into hospital to have their large ear keloids removed.

The three cases of exfoliative dermatitis(703) were all males aged about fifty years old, and they were all fatal. In two cases it was possible to determine the cause. In one it followed the administration of sulphapyridine, and in the other the injection of neoarsphenamine.

The cases of dermatitis(703) formed a motley group and in most cases no exact diagnosis was recorded. This is not surprising for the average European doctor finds African dermatology far from easy. Changes in skin colour are difficult to detect in an African. The only

changes detectable in an African skin are increase or decrease in pigmentation, apart from the uncommon case in which changes in skin texture are present. Loewenthal(1936) admits that the diagnosis of skin diseases in the African needs considerable practice.

The patient with erythema multiforme(705) was a female of twenty who developed the rash after the administration of sulphapyridine. Acne vulgaris(714) is commoner than our single case suggests for it is usually treated in the outpatient department. Minor degrees of vitiligo(716) are not uncommon, and our single hospital admission was of a boy of seven whose father requested us to try and get rid of his white patches, which we failed to do.

Tropical ulcer(715):

Orr and Gilks(1931) devoted the third section of their report on the physical condition of the Kikuyu and the Masai to a consideration of tropical ulcer as it occurred amongst the Kikuyu. They found the condition to be very common, and from their description it appears to have been much more severe than it is to-day. They tell of patients with tendons sloughing and sequestra forming in the base of the ulcers. Such features are rarely seen to-day. They suggested that trauma may be the immediate cause of the ulceration, but a dietary factor lay at the root of the delayed healing of the ulcer.

The condition is still common as our outpatient and

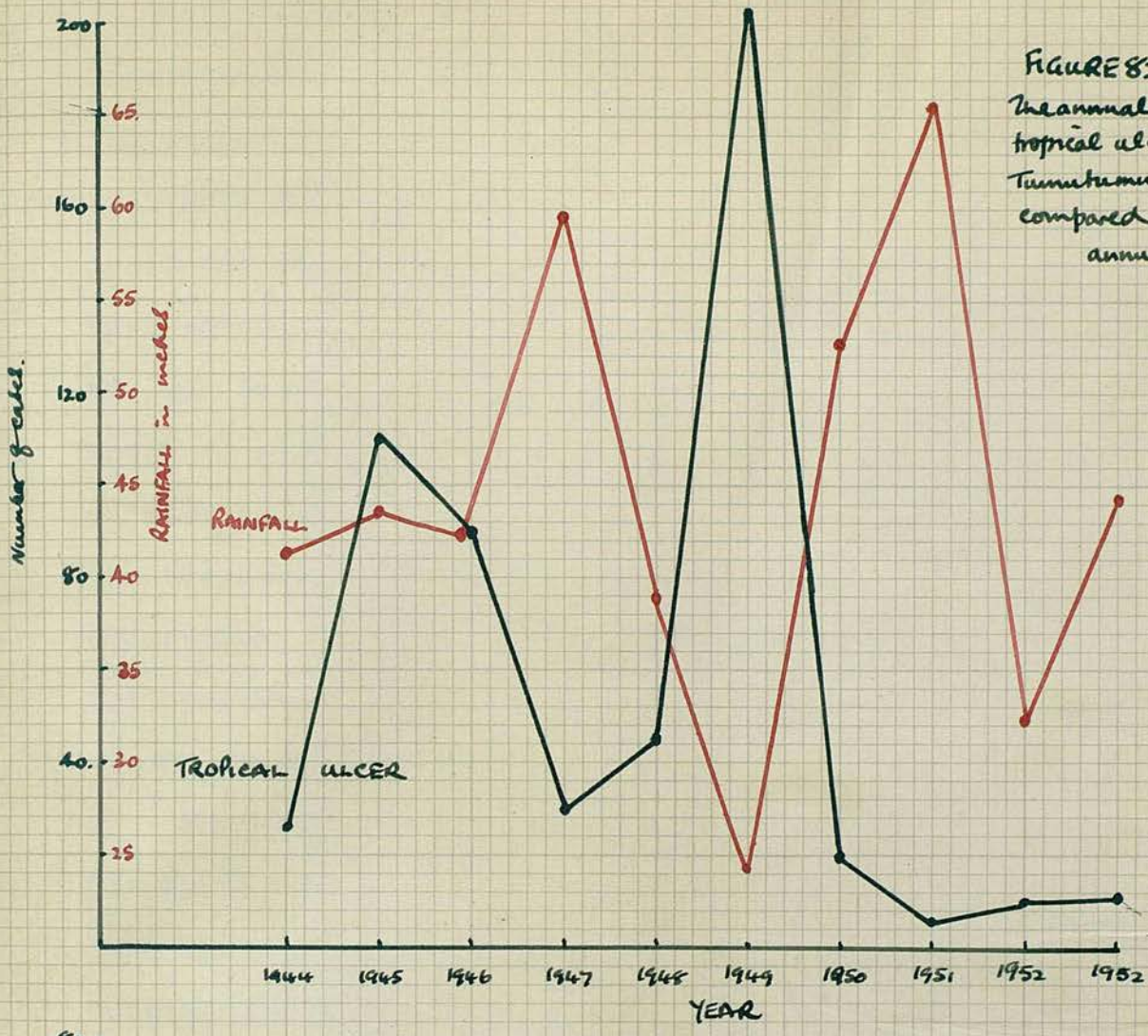


FIGURE 82:
The annual incidence of tropical ulcer amongst Tumutumu Hospital inpatients compared with mean annual rainfall.

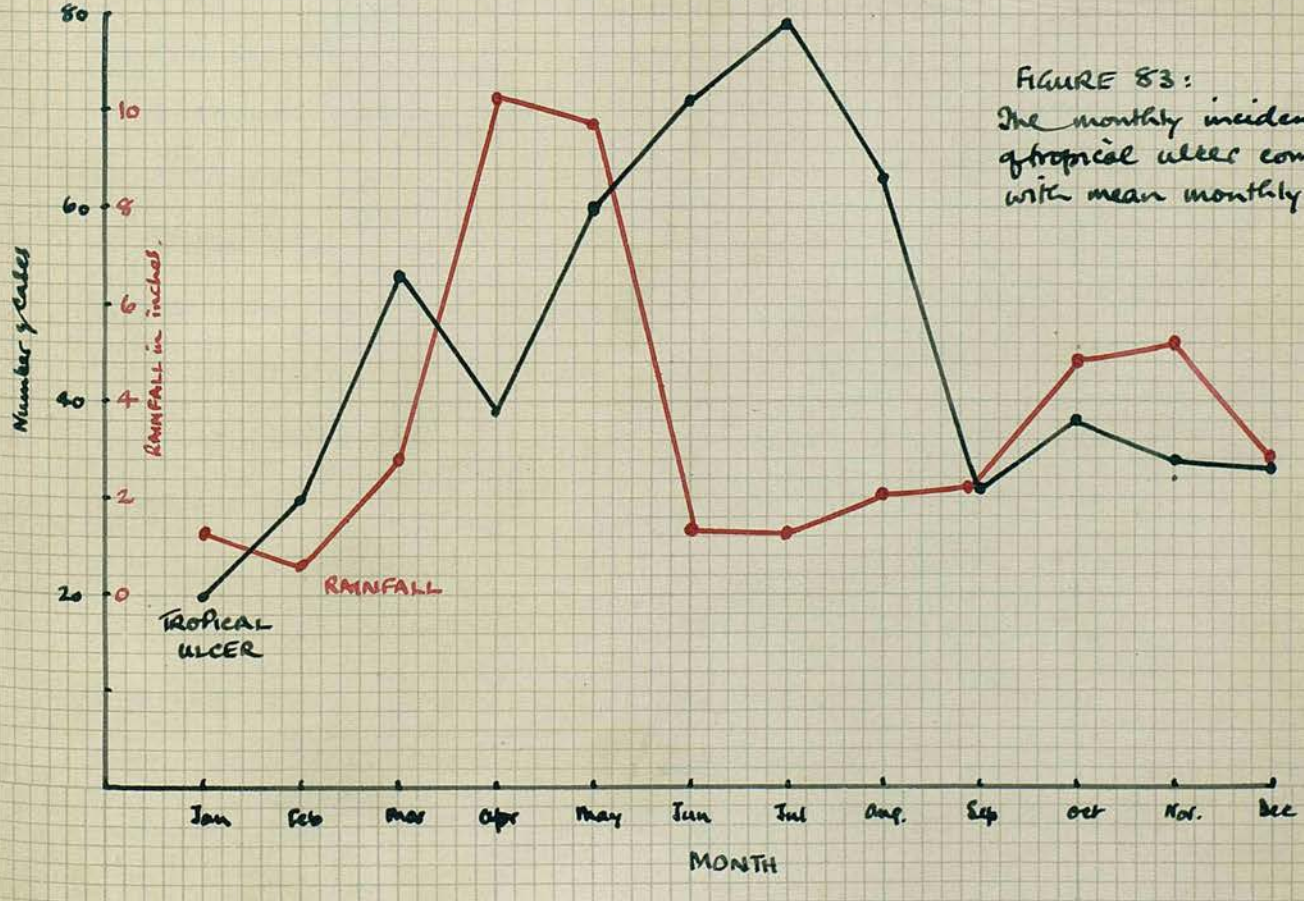
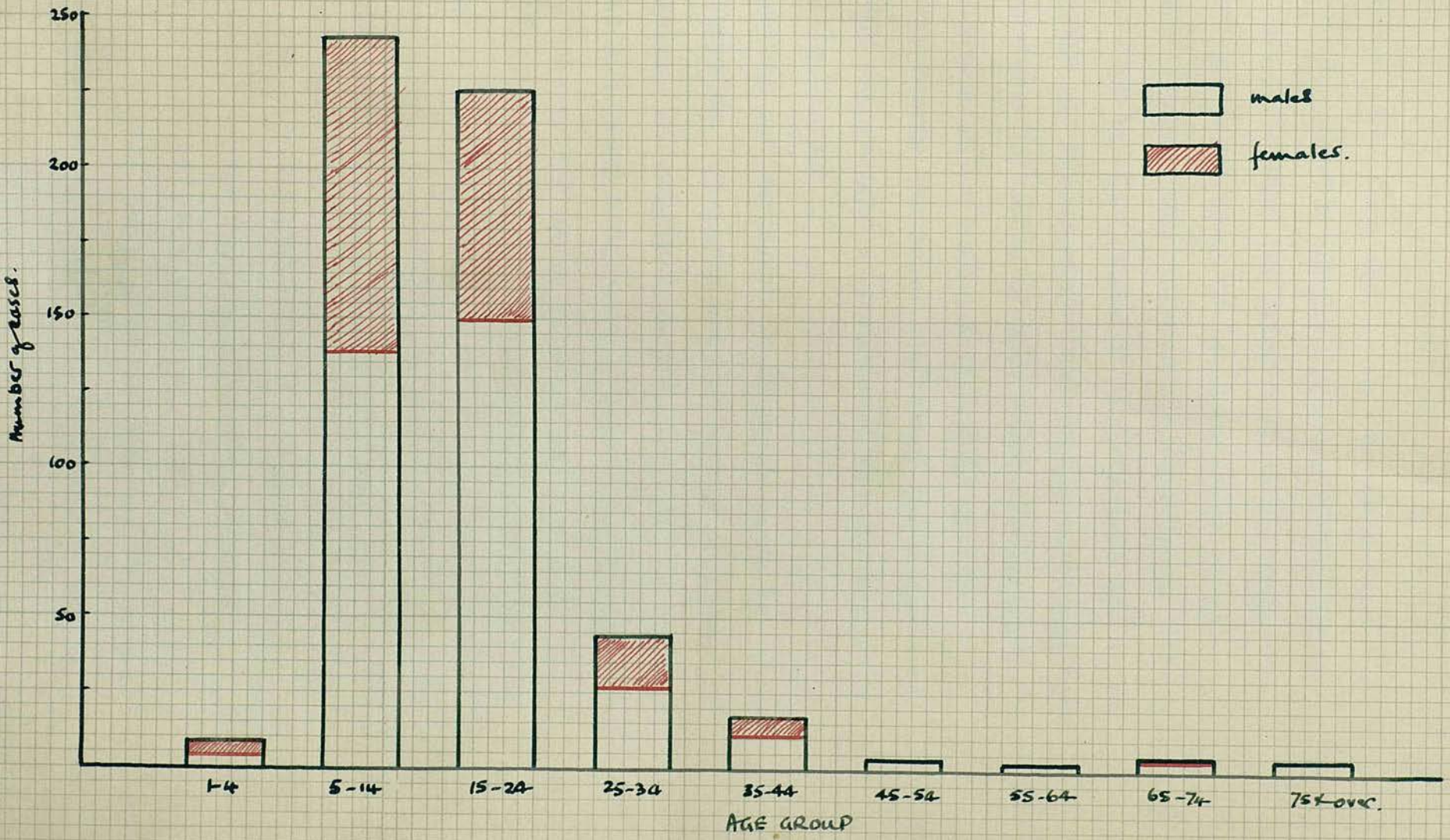


FIGURE 83:
The monthly incidence of tropical ulcer compared with mean monthly rainfall.

inpatient figures show. Figure 82 shows the annual incidence of tropical ulcer. If the main factor in the incidence of the lesion is a nutritional one then that incidence should show an inverse relationship to the mean annual rainfall. This value is plotted on Figure 82, and there does appear to be such a relationship which is most marked in the case of the dry year 1949. It must be remembered that these cases are inpatients who therefore represent the more severe cases of ulceration. Unfortunately our outpatient figures are not complete and so we cannot present a complete picture of the incidence of tropical ulcer.

The monthly incidence of tropical ulcer is given in Figure 83 and compared with the mean monthly rainfall. Here again there appears to be an inverse relationship between the two, though it is not quite so definite as in the annual figures. However, it must be remembered that these figures are for inpatient discharges and so we must take into account the length of stay in hospital of these cases. This was usually at least two weeks and often more in those cases which required skin grafting. Thus it would probably give a truer picture if we advanced the figures of incidence by one month. This changes the relationship and make it a direct one in the case of the long wet season. This is what we would expect for the month or so before the rains come and the wet months are the months when food is less plentiful. If the important deficiency in tropical ulcer is that of vitamin A(Mackie,Hunter and Worth,1945) and the Kikuyu diet is

FIGURE 84 : The age and sex incidence of 551 cases of tropical ulcer.



already low in its carotene content, as we have seen that it is, then such a deficiency will show itself rapidly when food becomes short. On the other hand when we are dealing with the more chronic deficiencies such as kwashiorkor then the effects are much longer in manifesting themselves. It is along these lines that we would explain the difference in incidence between two such manifestations of malnutrition as tropical ulcer and kwashiorkor. The annual incidence does not show the influence of short-term variations and so an inverse relationship is found to obtain there for the wetter the year, the better the crops and the lower the incidence of malnutrition and its various manifestations.

The age and sex incidence of tropical ulcer is given in Figure 84. There is a three to two preponderance of males, and eighty-five per cent. of the cases occur in the age group 5-24 years. Most cases appear round about puberty and early adolescence, and they may be related to the increased development seen at this period.

XIII. DISEASES OF THE BONES & ORGANS OF MOVEMENT:

These form only 0.3 per cent. of our inpatient discharges from Tumutumu Hospital, and they tend to be acute in type rather than chronic.

There were eleven cases of acute pyogenic arthritis, of whom nine were males. Their ages ranged from ten to

sixty-six. In the case of the male of sixty-six years the infection followed a penetrating knife wound, but in the other cases the cause was obscure. The knee was the joint involved in eight cases, and the hip followed next with two cases. All cases responded to aspiration and penicillin therapy.

Rheumatoid arthritis was seen in one patient, an old woman of sixty years who was the mother of our senior African midwife. She showed the typical hand deformities of the disease and there was no doubt about the diagnosis even though it was a rare disease amongst Africans.

Osteoarthritis is probably commoner than our figure of five cases suggests, and now that x-ray facilities are available it should be diagnosed more often. All our cases were males. The joints involved were the shoulder (three cases aged forty-five, fifty and sixty-eight), the left wrist(boy of fourteen following Colles fracture), and the right tempоro-mandibular joint(male aged twenty-four).

Muscular rheumatism is a dumping ground for various lesions and is not easy to analyse. Three cases were thought to be "yaws rheumatism", but in most cases it would be safer to diagnose them as muscular pains of unknown origin.

Ganglion is not uncommon in the Kikuyu and many cases were treated as outpatients.

The cases of tropical myositis are of interest in view of the observation of Trowell,Davies and Dean(1954) that this lesion appears to be confined to those areas

where protein malnutrition is common. It is probable that a number of cases in this series are included in the category of abscess(692) and our small number does not represent the total which occurred. Three of our cases were in females aged five to seven years, and one in a male aged thirty. All the muscles affected were in the lower limb, either the thigh or the calf.

XIV. CONGENITAL MALFORMATIONS:

We can merely record the conditions that are noted on the case records in this section. It is not possible to arrive at an accurate estimate of their incidence in the population. Many of the notes on infants born with abnormalities were included on the mother's case sheet and these were not preserved.

The malformations seen in this series were as follows:

Spina bifida & meningocele	2 cases
Congenital hydrocephalus	12 cases
Congenital heart disease	
Aortic stenosis	1 case
Auricular septal defect	1 case
Morbus coerulus	1 case
Unspecified	6 cases
Harelip	2 cases

The patient with congenital aortic stenosis was a girl aged thirteen who died from pulmonary tuberculosis. The auricular septal defect was found in a male infant

who died at the age of three weeks. Cyanotic heart disease was diagnosed in a male infant who died seventeen days after birth, but no post-mortem examination was done. The unspecified lesions were all in females, who were aged four, five and eight years. The older two died.

XV. DISEASES OF EARLY INFANCY:

Haemolytic disease of the newborn(770):

In Africans only four per cent. of the population are rhesus negative compared with fifteen per cent. of the European population(Carothers,1953). Even so, it is probable that haemolytic disease of the newborn is commoner than our three cases in ten years would suggest. Again many of the notes would have been entered on the maternity case sheets and then erased so that the sheets could be used again.

Of our three cases one was born dead and was diagnosed as a case of hydrops foetalis, and the other two were born alive but died in deep jaundice on the third day of life. All these cases were males.

Haemorrhagic disease of the newborn(771):

Four cases were diagnosed as suffering from this disease and all were fatal though the cause of death was not specified in the case notes. Two were twins who died on the second day of life. The other two died on the first and third day of life respectively. All except one of the twins were females.

Sclerema neonatorum(773):

This curious condition is not uncommon amongst the Kikuyu newborn, but we are unable to give any figures of its incidence. It is characterised by a hardening of the subcutaneous fat of the limbs, cheeks, back and buttocks within the first few days of life. Its aetiology is unknown, and no form of treatment has any effect on the course of the disease for death invariably occurs after some days.

NXVII. ACCIDENTS, POISONINGS AND VIOLENCE:

Figure 85 sets out the annual incidence of wounds and injuries due to external causes in our series. The annual figures used are the total figures derived from the addition of the cases in the following six categories for each year.

N829	Fractures,	N852	Concussion,
N839	Dislocations,	N908	Wounds, and
N848	Sprains,	N929	Contusions.

The marked increase in the number of cases of violence in the years 1952 and 1953 was due to the activity of the Government security forces and the Mau Mau terrorists. A separate note is appended below on wounding caused by the Mau Mau gangsters.

FIGURE 85:
Annual incidence of wounds and injuries due to external causes in Tumutumu area 1944 - 1953

Fractures and dislocations:

The age and sex incidence of fractures and dislocations seen amongst the inpatient discharges from Tumutumu Hospital is given in Figure 86. Males are involved three times more often than females. This finding is rather surprising since it is the females who do the heavy load carrying in Kikuyuland. The age group chiefly affected by fractures and dislocations is the 5-14 years for forty per cent. of the cases occurred in this group. This is the age group chiefly concerned with the herding of sheep and cattle, and it is the time when the boys in particular are exploring the delights of the countryside and climbing trees and fighting with each other.

The bones fractured in this series are analysed in Table LXXVIII. The commonest single bone fractured by the Kikuyu is the left humerus. When, however, the figures for both sides of the body are combined, the femur is the bone most often broken. The bones on the left side of the body are more often broken than those on the right side in the proportion of three to two. The bones of the shoulder girdle and upper limb are broken twice as often as those of the lower limb, and the phalanges of the hand are broken three times as often as those of the foot. The absence of fractures of the neck of the femur

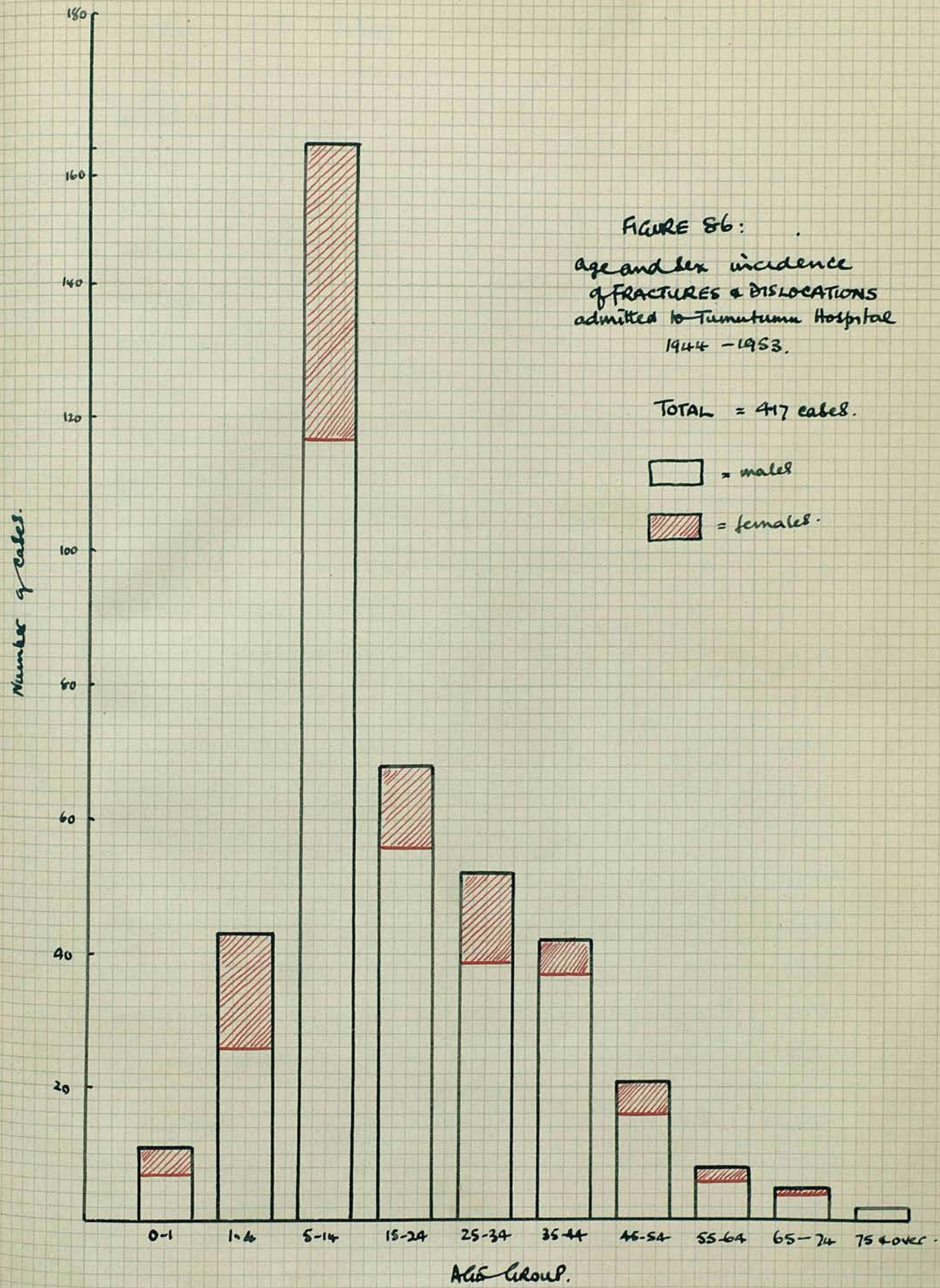


FIGURE 86:

Age and sex incidence of FRACTURES & DISLOCATIONS admitted to Tumutumu Hospital 1944 - 1953.

TOTAL = 417 cases.

= males

= females.

BONE	RIGHT	LEFT	UNSPEC.	TOTAL	PERCENT
Skull	-	-	-	25	6.5
Spine	-	-	-	1	0.3
Ribs	3	3	5	11	2.9
Pelvis	1	1	-	2	0.6
Maxilla	-	-	2	2	0.6
Mandible	3	2	-	5	1.3
Teeth	-	-	1	1	0.3
Clavicle	10	12	3	25	6.5
Humerus	13	39	11	63	16.7
Radius	4	7	4	15	4.0
Ulna	2	3	3	8	2.1
Radius & ulna	16	20	3	39	10.1
Colles' fracture	11	9	1	21	5.5
Metacarpus	-	2	2	4	1.2
Phalanges(hand)	11	21	5	37	10.0
Femur	31	27	10	68	18.0
Tibia	5	7	1	13	3.4
Fibula	-	1	1	2	0.6
Tibia & fibula	4	6	9	19	5.0
Potts' fracture	-	3	-	3	0.9
Metatarsus	-	1	-	1	0.3
Phalanges(foot)	3	7	2	12	3.2
TOTAL	116	171	90	377	100.0

Table LXXVIII. Analysis of cases of fractured bones amongst the Kikuyu of South Nyeri District, 1944-1953.

from this series is noteworthy. The common fracture of the femur seen was almost invariably that of the shaft.

The dislocations of joints seen in patients in this series are analysed in Table LXXIX and set out in order of frequency. The joints on the left side of the body are involved only slightly more often than those on the right side, but our figures are too small to base any definite conclusion on. In the case of fractures there was a greater preponderance of these on the left side than on the right(See Table LXXVIII). The commonest joint dislocated is the hip joint, which is of interest in view of the fact that the femur was the commonest bone fractured. The shoulder and elbow joints were the next most commonly dislocated. Upper limb joints were more often dislocated than lower limb joints, an observation which corresponds to the similar observation made in connection with upper limb fractures.

It is to be noted, however, that the numbers in our series of fractures and dislocations are small and therefore any deductions from them can only be tentative until larger series are published.

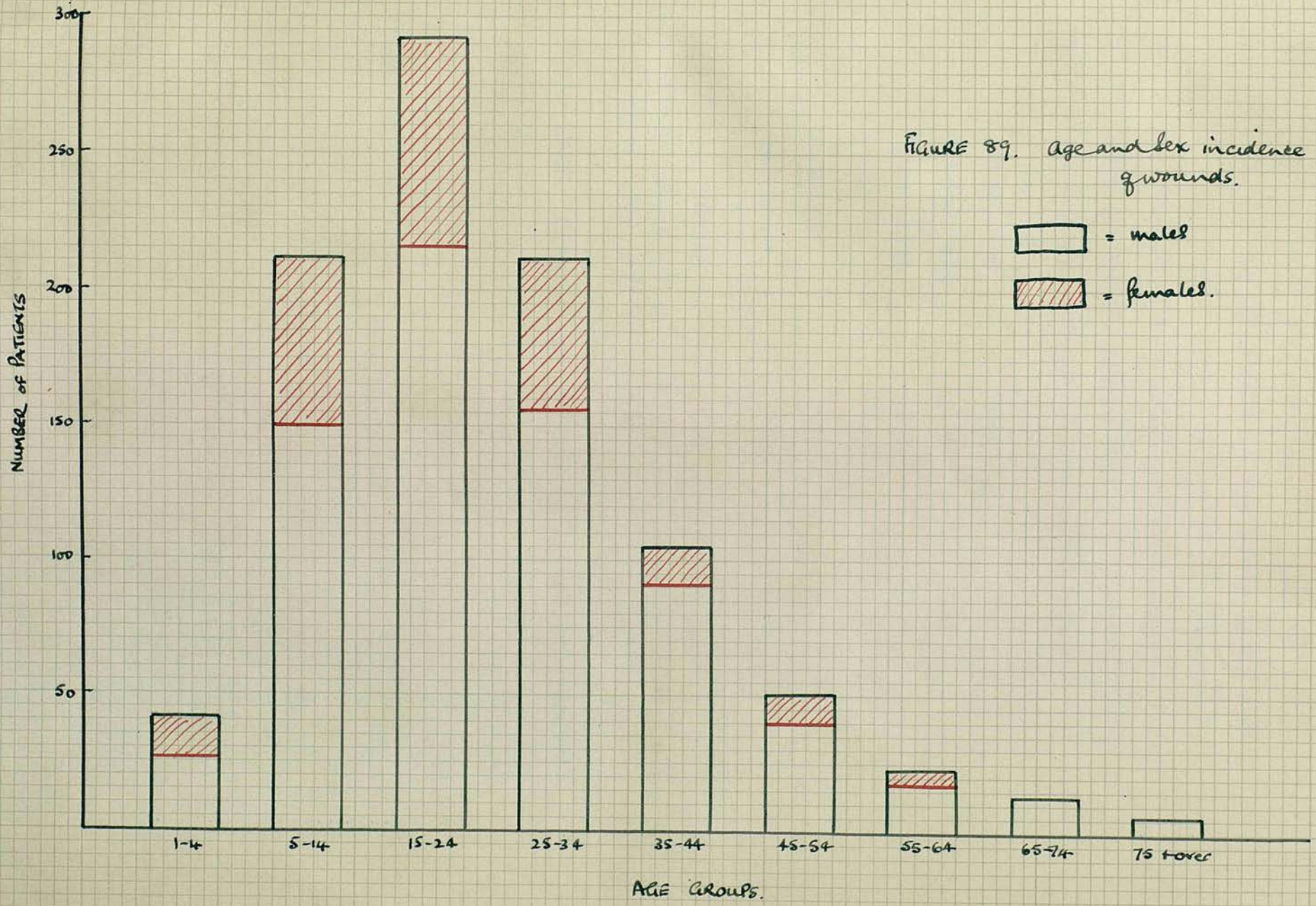


FIGURE 89. age and sex incidence of wounds.

= males

= females.

The site of the open wounds(N908) is given in Table LXXX in order of frequency. It will be noted that the majority were in the lower limb, and

SITE OF WOUND	TOTAL NUMBER	PERCENT.
Lower limb	321	45.0
Head & neck	154	21.7
Upper limb	147	20.7
Trunk	42	5.9
Multiple	35	4.9
Genitalia	13	1.8
TOTAL	712	100.0

Table LXXX. Site of open wounds in Kikuyu inpatients.

this is due to the large number of persons who were injured by their own or another's cultivating knife or axe, or by a stick or tree stump. The wounds of the genitalia have been listed separately for in the case of the males they almost amount to an occupational hazard. Ten of these patients with genital wounds were small herd-boys who had been gored by the horn of a cow or a ram usually with laceration of the scrotum and exposure of a testis. The other three were in females who had sat down on an upright stick.

In only about half the cases was the side affected noted in the case records. In fifty-two per cent. of these cases the wound involved the left side, compared with the figure of sixty per cent. for left-sided fractures and dislocations.

The causation of four hundred and fifty-five cases of wounds, abrasions and contusions is given in Table LXXXI. It is of interest to analyse each of the causes further where this is possible for this gives a picture of the ordinary activities and relationships of the Kikuyu people. The eighty-nine cases in which falling was the cause of the injury may be analysed further as follows:

Fall from tree	7 cases
Fall from lorry	6 cases
Fall from train	3 cases
Unspecified	73 cases

	NUMBER	PERCENT.
Weapon	153	33.7
Vehicle accident	122	26.8
Fall	89	19.6
Beating	27	5.9
Crush injury	26	5.7
Kick	20	4.4
Goring	11	2.4
Bite	7	1.5
TOTAL	455	100.0

Table LXXXI. Causation of wounds in the Kikuyu of South Nyeri District.

The weapons or other objects which were responsible for the wound or injury in 33,7 per cent. of the cases were as follows:

Cultivating knife	49	Spear	4
Hand axe	31	Thorn	3
Stick	27	Hammer	1
Hunting knife	21	Arrow	1
Hand saw	8	Razor	1
Garden hoe	7		

It is of interest to note the few casualties due to the spear, the sword and the bow and arrow.

The number of vehicle accidents in our series is an indication of how much the Kikuyu country has been opened

up to modern means of transport, and in particular how popular the bicycle is. The vehicles concerned were the following:

Bicycle	71 cases
Motor car	40 cases
Railway train	11 cases.

The crush injuries reflect how careless the Kikuyu are in tree felling. The causation of these injuries is as follows:

By tree	21 cases
By earth	4 cases
By hut wall	1 case.

The cases crushed by an earth fall were women who were quarrying for the special type of clay used for making earthernware pots.

Of the kicks which caused injury, fifteen were human, four were due to cattle, and one to a donkey. Of the human ones twelve were sustained on the football field. Of the cases of goring, seven were by cows and four by rams.

Wounds due to Mau Mau violence:

In order not to give a false picture the wounds due to Mau Mau activity were not included in Table LXXXI. Yet at Tumutumu Hospital we had a unique experience of the results of Mau Mau violence and so it is appropriate to summarise here what has been reported at greater length elsewhere(Wilkinson,1954) of our experience of Mau Mau

methods. The report referred chiefly to cases admitted to Tumutumu Hospital during the period from November 1952 to May 1954.

The effectiveness of the killing methods used by the Mau Mau terrorists is evident from our figures. Of two hundred and eleven victims brought to hospital, only thirty-nine or 18.5 per cent. were discharged alive. One hundred and sixty-six or almost seventy-nine per cent. were dead on admission.

Over eighty-five per cent. of these admissions were adults in the prime of life, and males predominated over females in the proportion of four to one.

In one hundred and twenty-seven cases the wounds were distributed as follows:

Head and neck	59.0%
Limbs	21.3%
Thorax	11.7%
Abdomen	8.0%

The wounds in most cases were multiple, and in several cases numbered over fifty all of which had been inflicted by cultivating knives or pangas.

In a series of over a thousand cases whose details were collected from all over Kikuyuland, the causation of the wounds inflicted by the terrorists was as follows:

Cultivating knife wounds	37.0%
Firearm wounds	32.0%
Strangulation	11.3%
Stab wounds	3.9%
Burning	2.7%

Multiple causation	6.9%
Other causes	6.2%

A favourite site of wounding with the panga or cultivating knife was the neck. The result was a cut throat or decapitation, both of which were effective in killing the victim. This kind of bloodthirsty violence is out of keeping with the character of the common Kikuyu people, and it is to be hoped that once it has gone it will not return.

Suicide amongst the Kikuyu:

Under normal conditions suicide is very uncommon amongst the Kikuyu people. It is difficult to obtain figures because not all cases are reported, but most medical officers can remember only an occasional case of suicide. In most cases it was a female and the method used was almost invariably hanging.

Under the threat of the Mau Mau suicides were not uncommon. There were thirty-two in Tumutumu area alone and a total of eighty-six were reported from Kikuyuland as a whole(Wilkinson,1954). This time the males committed suicide three times more often than the females. All the females hanged themselves, and the majority of the males. Two males cut their own throats and one shot himself. The peak incidence of suicide coincided with that of murders by the terrorists, and were presumably prompted by fear of murder at the hands of the brutal terrorists.

Snake bite(N918):

Snake bite is not common amongst the Kikuyu when it is remembered how close to Nature they live and how they often shelter snakes in the thatched roof of their huts. In none of the sixteen cases was the snake identified. The Kikuyu have no specific names for snakes, but call all snakes njoka which really means a worm, or nyamu ya thi which means the beast of the ground. Several venomous species are known to occur in Kikuyuland according to Loveridge(1946). These include Gunther's coral snake(Elapsoidea sundevallii guntherii), the Egyptian cobra(Naja haje), the spitting cobra(Naja nigricollis) and the puff-adder(Bitis arietans).

Eleven of our sixteen cases were in males, and seven of them were in the 5-14 age group. None of the bites were fatal.

Burns and scalds(N949):

In the confined space of a Kikuyu hut it is very easy for young children to stumble into the fire which is kept burning in the centre of it and burn themselves as they play. Or they may upset hot gruel on to themselves from the pot which is balanced on three stones over the fire. We have already noted how epilepsy commonly presents itself as a burn caused when the patient falls into the fire during a convulsion.

The age and sex incidence of the burns and scalds seen in this series is given in Figure 91. Males predominate, and the peak incidence is found in the

FIGURE 91.

Age and sex incidence of burns and scalds admitted to Tumutumu Hospital 1944-1953.

Total = 124 cases.

= males

= females.

1-4 years age group. The case fatality rate for this series of burns was seventeen per cent.

Poisoning amongst the Kikuyu:

All the cases of poisoning included in this series were accidental in origin. Deliberate poisoning of a person is very rarely encountered in practice, though it is often alleged to have happened. Criminal poisoning is said to have been not uncommon in former times, but we have no evidence to prove this was so.

The Kikuyu arrow poisons are cardiac glucosides derived from the leaves of a species of Acocanthera and are similar to those described in Tanganyika Territory by Raymond(1939). There is little information on the other methods of poisoning, but Datura stramonium is not uncommon as a weed, and the Kikuyu recognise its toxic properties.

Kerpsene is not uncommonly misteken for water by children, and we see the occasional case of kerosene poisoning in outpatients. One was admitted to hospital and recovered. He was a male of one year old. The case of turpentine poisoning was in a female of forty-five who drank some turpentine liniment.

The three patients with carbon tetrachloride poisoning were all adults, two were female and one male. They had

all been given this drug as an anthelmintic. One, a female of forty-five died as a result. There are more cases of santonin poisoning because this drug is freely available as "worm tablets" in the African and Indian shops. Six cases were admitted, five under the age of thirteen, and one, a male of one year, died.

The two cases of serum reaction(N998) occurred after yellow fever inoculation in two youths who were inoculated prior to leaving Kenya for overseas education.

The last condition given in Table XLI on which we must comment is the occurrence of sinuses following the intramuscular injection of quinine. There were seven cases of this and all were in the 4-25 years age group. Unfortunately it is impossible to determine how many intramuscular injections of quinine during the ten years under review with any accuracy, but it is probable that seven cases represents a very low incidence amongst the many hundreds of injections which must have been given during that time. Nevertheless such sinus formation does occur and must be accepted as a hazard of this method of administering parenteral quinine.

This concludes the sections concerned with the morbidity of South Nyeri District. We now come to the final section in which we are to consider the mortality of the district.

SECTION VI. THE MORTALITY OF SOUTH NYERI DISTRICT.

THE MORTALITY OF SOUTH NYERI DISTRICT

In our earlier discussion of the vital statistics of South Nyeri District we quoted the estimate of the death-rate for Kenya Africans given by Goldthorpe(1955). He suggested that the death-rate might be in the region of twenty-eight per thousand. The figures we are concerned with in the present section are derived from the three hospitals of South Nyeri and if Goldthorpe's estimate is at all accurate, it is obvious that the statistics of deaths in hospitals are most inadequate for the calculation of the death-rate. Over the ten years of this study the annual death rate averaged 353.2 per year in hospital patients. The population during this time according to our estimate given in Table VI averaged 185,000 per year. These figures give a crude death-rate of approximately two per thousand. This figure is an impossibly low one which has not even been achieved by much more civilised communities than the Kikuyu. The Registrar General in the Statistical Review of England and Wales for 1940-1945 gave figures which showed that for these six years the crude death-rate averaged 13.1 per thousand of the civilian population.

Our mortality figures are therefore as much a sample of the whole as the morbidity figures were, and they may perhaps represent about seven per cent. of the total deaths amongst the people of the South Nyeri District. It will be difficult to use them to establish any exact

relationships. The main use which can be made of them is for the determination of the fatal diseases amongst the Kikuyu people, at least so far as hospital practice is concerned.

The total annual mortality in the three hospitals in South Nyeri District is given in Table LXXXII. The crude death rate per thousand of the population is worked out from these figures and given in the last column.

YEAR	TOTAL DEATHS	CRUDE DEATH RATE
1944	338	2.01
1945	320	1.85
1946	359	2.04
1947	321	1.79
1948	358	1.96
1949	408	2.18
1950	380	1.99
1951	352	1.81
1952	311	1.57
1953	385	1.90
AVERAGE	353	1.91

Table LXXXII. Total annual hospital mortality and crude death rate per thousand in South Nyeri District.

Table LXXXIII gives the coefficients of correlation of the total annual death rate with the climatic data already presented in Table XI. The total annual mortality

shows most correlation with the mean annual rainfall. The relationship is an inverse one, and so the drier the year, the greater is the number of deaths which occur in it.

ANNUAL MEAN VALUE	HOSPITAL DEATHS
Temperature	- 0.05
Rel. humidity	- 0.04
Rainfall	- 0.34
Cloud amount	- 0.02

Table LXXXIII. Coefficients of correlation of annual climatic data with total annual hospital mortality.

The total mortality figures for each month are not available for every year of the decade, but only for the years 1946, and 1948 to 1953. The average number of deaths for each month over the period of these seven years is given in Table LXXXIV. It will be seen that the number of deaths in hospital each month varies from twenty-seven to forty-one, with an average of thirty-four per month.

The coefficients of correlation have been worked out for the monthly mortality and the climatic data given in Table XII. These coefficients are shown in Table LXXXV. None of the data shows any very significant correlation with the mortality.

MONTH	DEATHS	MONTH	DEATHS
JAN	36	JUL	37
FEB	37	AUG	27
MAR	35	SEP	32
APR	40	OCT	30
MAY	40	NOV	27
JUN	41	DEC	29
	AVERAGE 34.1		

Table LXXXIV. Average monthly mortality in the hospitals of South Nyeri District.

MONTHLY MEAN VALUE	HOSPITAL DEATHS
Temperature	+ 0.05
Rel. humidity	- 0.11
Rainfall	+ 0.26
Cloud amount	- 0.21

Table LXXXV. Coefficients of correlation of monthly climatic data with average monthly hospital mortality.

It is of great interest to compare the mortality amongst inpatients as seen in each of the three hospitals of South Nyeri District. This is done in Table LXXXVI.

HOSPITAL	TOTAL INPATIENTS	DEATHS	PERCENTAGE
Tumutumu	20,761	1,522	7.3
Consolata	13,295	507	3.8
Nyeri	57,946	1,503	2.5
AVERAGE	30,667	1,177	4.5

Table LXXXVI. Comparison of the percentage mortality at the three hospitals of South Nyeri District 1944-53.

The difference between the percentage inpatient mortality rate for Tumutumu and that for Nyeri is quite striking. It can only be explained by a difference at the two hospitals dictated principally by the pressure

on beds at the Nyeri Government Hospital. We saw in Table XXXIII that Nyeri Hospital admitted more than twice the number of inpatients that Tumutumu did for the same number of beds. This means that at Nyeri Hospital acute cases must have priority over chronic cases, and that patients will be sent home to die when nothing more can be done for them. At Tumutumu there is less pressure on beds and there will therefore be a tendency to keep chronic cases even though it is obvious that they are not going to recover. This is not the whole picture, however, for a perusal of Table LXXXIX will show that Tumutumu shows a higher number of deaths than Nyeri for such acute diseases as whooping cough, measles and gastro-enteritis. In general, however, it would be true to say that Tumutumu Hospital admits a larger number of chronic cases than Nyeri and therefore shows a higher mortality.

The sex distribution of mortality amongst our series of 1,522 deaths was as follows:

Males	54.9%
Females	45.1%

The percentage age distribution of mortality for Tumutumu inpatients is given in Table LXXXVIII. The age distribution of deaths is much the same in the two sexes. It is noteworthy that eighty per cent. of the deaths occur

under the age of 24 years. These figures are based on a relatively small number of cases, and these cases are derived from a very selected group, namely that of inpatient discharges of one hospital in Kikuyuland and so it is not profitable to analyse them further or to base any firm conclusions on them.

AGE GROUP	MALE	FEMALE	AVERAGE
0-1	18.5%	20.0%	19.2%
1-4	38.0%	35.0%	36.5%
5-14	13.5%	11.0%	12.3%
15-24	11.0%	13.0%	12.0%
25-34	6.5%	12.0%	9.3%
35-44	3.6%	4.0%	3.8%
45-54	3.3%	2.0%	2.6%
55-64	3.3%	1.0%	2.2%
65-74	1.2%	1.3%	1.2%
75 & over	1.1%	0.7%	0.9%
TOTAL	100.0%	100.0%	100.0%

Table LXXXVII. The percentage age distribution of fatal cases amongst the Tumutumu Hospital inpatients for 1944-1953.

We turn now to consider the diseases which caused death amongst the population of South Nyeri District. They are listed and analysed for the three hospitals in Table LXXXIX given below.

The mortality figures for Tumutumu Hospital were obtained from an inspection of the case records and an attempt was made to check the final diagnosis against the notes about the patient. The figures for Nyeri Hospital were taken from those given in the Annual Reports of the Hospital for the ten years 1944 to 1953. The figures for the Consolata Hospital were those given in the monthly return of deaths submitted by the Hospital to the Nyeri Medical Officer of Health. It has thus not been possible to check the final diagnosis against the findings during life in the case of Nyeri and the Consolata Hospital, and there are a few places in which the real cause of death must remain in doubt. It is unlikely, for instance, that ophthalmia neonatorum was the real cause of death in the eight cases entered as having died from that disease at Nyeri Hospital.

DISEASE	NUMBER OF DEATHS			
	TUMUTUMU	NYERI	CONSOLATA	TOTAL
I. INFECTIVE & PARASITIC DISEASES:				
008 Tuberculosis	291	174	47	512
022 Aneurysm of aorta	0	0	1	1
029 Syphilis	7	16	4	27
040 Typhoid fever	41	84	4	129
045 Bacillary dysentery	10	21	4	35
046 Amoebiasis	0	9	9	18
049 Food poisoning	0	5	0	5
052 Erysipelas	0	1	0	1
053 Septicaemia & pyaemia	0	4	1	5
056 Whooping cough	78	21	7	106
057 Meningococcal meningitis	0	61	0	61
058 Plague	1	11	0	12
060 Leprosy	2	1	0	3
061 Tetanus	73	75	9	157
062 Anthrax	7	49	1	57
063 Gas gangrene	1	0	0	1
070 Vincent's infection	0	0	1	1
071 Relapsing fever	15	33	0	48
073 Yaws	0	2	0	2
080 Acute poliomyelitis	1	7	2	10
084 Smallpox	1	2	0	3
085 Measles	23	0	1	24
092 Infectious hepatitis	0	1	0	1
112 Blackwater fever	2	1	0	3

DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
116 Malaria	18	107	3	128
130 Ascariasis	0	1	0	1
II. NEOPLASMS:				
144 Malignant of mouth	1	0	0	1
148 Malignant of pharynx	1	0	0	1
150 Malignant of oesophagus	1	0	0	1
153 Malignant of colon	1	0	0	1
158 Malignant of liver	8	7	4	19
161 Malignant of larynx	1	0	0	1
170 Malignant of breast	3	0	0	3
174 Malignant of uterus	3	2	0	5
177 Malignant of prostate	3	0	0	3
191 Epithelioma of skin	1	0	0	1
199 Sarcoma	1	0	0	1
201 Hodgkin's disease	1	1	0	2
202 Other reticuloses	1	0	0	1
204 Leukaemia	2	0	3	5
216 Ovarian cyst	0	0	1	1
III. ALLERGIC, ENDOCRINE, METABOLIC & NUTRITIONAL:				
241 Asthma	0	3	0	3
250 Simple goitre	0	0	1	1
260 Diabetes mellitus	2	0	1	3
286 Kwashiorkor	86	59	22	167
286 Malnutrition	9	9	0	18

DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
IV. DISEASES OF THE BLOOD:				
296 Purpura	1	0	3	4
290 Haemophilia	0	1	0	1
V. MENTAL DISORDERS:				
309 Insanity	0	14	0	14
VI. DISEASES OF THE NERVOUS SYSTEM & SENSE ORGANS:				
330 Subarachnoid haemorrhage	2	0	0	2
334 Hemiplegia	7	12	1	20
340 Purulent meningitis	70	18	35	123
342 Cerebral abscess	0	0	2	2
343 Encephalomyelitis	0	7	9	16
350 Paralysis agitans	1	0	0	1
352 Cerebral diplegia	1	0	2	3
353 Epilepsy	0	3	1	4
356 Motor neurone disease	1	0	0	1
391 Otitis media	0	1	0	1
VII. DISEASES OF THE CIRCULATORY SYSTEM:				
400 Rheumatic fever	0	1	0	1
410 Mitral heart disease	15	15	0	30
411 Aortic valve disease	1	1	1	3
430 Subacute endocarditis	1	0	3	4
432 Acute pericarditis	1	2	1	4
434 Congestive heart failure	15	0	13	28
465 Pulmonary embolism	1	0	3	4
468 Lymphoedema	0	1	0	1

	DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
VIII.	DISEASES OF THE RESPIRATORY SYSTEM:				
473	Acute tonsillitis	0	4	1	5
490	Lobar pneumonia	36	128	14	178
491	Bronchopneumonia	265	219	58	542
517	Respiratory obstruction	6	0	3	9
518	Empyema	0	4	0	4
521	Lung abscess	0	1	4	5
526	Bronchiectasis	0	2	0	2
IX.	DISEASES OF THE DIGESTIVE SYSTEM:				
536	Stomatitis	0	1	0	1
541	Ulcer of the duodenum	1	0	3	4
544	Dilatation of stomach	0	0	1	1
550	Acute appendicitis	0	2	0	2
561	Strangulated hernia	0	4	0	4
570	Intestinal obstruction	12	22	9	43
571	Gastro-enteritis	238	54	110	402
576	Peritonitis	2	3	8	13
580	Atrophy of liver	0	0	1	1
581	Cirrhosis of liver	8	28	1	37
583	Hepatitis	0	0	8	8
587	Pancreatic cyst	0	1	0	1
X.	DISEASES OF GENITO-URINARY SYSTEM:				
590	Acute nephritis	6	10	20	36
592	Chronic nephritis	0	4	4	8
600	Acute pyelonephritis	0	0	3	3

DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
610 Prostatic hyperplasia	3	1	0	4
622 Acute salpingitis	0	1	0	1
XI. DELIVERIES AND COMPLICATIONS:				
642 Eclampsia	0	0	1	1
645 Ectopic gestation	1	0	1	2
677 Ruptured uterus	6	3	2	11
678 Abnormal delivery	27	47	5	79
XII. DISEASES OF SKIN & CELLULAR TISSUES:				
692 Cellulitis & abscess	0	11	0	11
703 Exfoliative dermatitis	3	0	0	3
704 Pemphigus	0	0	3	3
715 Tropical ulcer	0	3	0	3
XIII. DISEASES OF BONE & ORGANS OF MOVEMENT:				
722 Rheumatoid arthritis	1	3	0	4
723 Osteoarthritis	0	1	0	1
730 Osteomyelitis	0	0	2	2
XIV. CONGENITAL MALFORMATIONS:				
751 Spina bifida	0	1	1	2
752 Congenital hydrocephalus	4	0	2	6
754 Congen. heart disease	5	0	1	6
756 Congen. pyloric stenosis	0	0	4	4
756 Imperforate anus	0	1	0	1

DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
XV. CERTAIN DISEASES OF EARLY INFANCY:				
765 Ophthalmia neonatorum	0	8	0	8
770 Haemolytic disease of the newborn	3	0	0	3
771 Haemorrhagic disease of the newborn	4	0	0	4
773 Sclerema neonatorum	2	0	0	2
776 Immaturity unqualified	32	15	2	49
XVI. SYMPTOMS, SENILITY & ILL-DEFINED CONDITIONS:				
780 Infantile convulsions	0	0	2	2
780 Coma	0	0	2	2
782 Splenomegaly	0	0	3	3
785 Jaundice	0	8	2	10
785 Ascites	0	3	2	5
786 Anuria	0	0	1	1
788 Pyrexia of unknown origin		4	2	6
790 Debility	0	6	2	8
790 Uraemia unqualified	0	2	10	12
794 Senility	7	6	2	15
NXVII. ACCIDENTS, POISONINGS & VIOLENCE:				
N829 Fracture, unspecified	6	11	1	18
N852 Concussion	1	0	0	1
N865 Injury to spleen	0	2	0	2
N908 Wounds, unspecified	7	5	2	14
N949 Burns	21	31	4	56

DISEASE	TUMUTUMU	NYERI	CONSOLATA	TOTAL
N963 Carbon tetrachloride poisoning	1	0	0	1
N979 Santonin poisoning	1	0	0	1
TOTAL	1,522	1,503	507	3,532

Table LXXXIX. Analysis of mortality at the three hospitals in South Nyeri District during the period 1944 to 1953.

As the above table is rather long, it is summarised below in Table XC. Here the diseases are added together to give the mortality for each of the groups of the International Statistical Classification(1948), and the percentage mortality in each group is given. It is at once obvious that the Infective and Parasitic Diseases are responsible for more deaths than any of the other groups, just as they were responsible for more cases of illness(see Table XLII). In the case of the other groups there is little correlation between their percentage morbidity and mortality as can be seen from Table XCI and Figure 94 where these are compared for Tumutumu Hospital since the percentage morbidity figure for all the hospitals is not available. The three groups which include the majority of the deaths are these of Infective and Parasitic Diseases, Respiratory Diseases and Digestive Diseases.

SECTION	TYPE OF DISEASE	DEATHS	PERCENTAGE OF TOTAL
I.	Infective & parasitic	1,351	38.3
II.	Neoplasms	46	1.3
III.	Allergic, nutritional etc.	192	5.5
IV.	Blood	5	0.1
V.	Mental	14	0.4
VI.	Nervous system	173	4.9
VII.	Circulatory system	75	2.1
VIII.	Respiratory system	745	21.1
IX.	Digestive system	517	14.6
X.	Genito-urinary	52	1.5
XI.	Deliveries	93	2.6
XII.	Skin & cellular tissue	20	0.6
XIII.	Bones & movement	7	0.2
XIV.	Congenital malformations	19	0.5
XV.	Early infancy	66	1.9
XVI.	Ill-defined conditions	64	1.8
NXVII.	Accidents & violence	93	2.6
	TOTAL	3,532	100.0

Table XC. Analysis of mortality in hospitals of the South Nyeri District 1944-1953.

SECTION	TYPE OF DISEASE	PERCENTAGE MORBIDITY	PERCENTAGE MORTALITY
I.	Infective & parasitic	50.8	37.5
II.	Neoplasms	0.4	1.8
III.	Allergic, etc.	1.8	6.4
IV.	Blood	0.1	0.1
V.	Mental	0.2	0
VI.	Nervous system	1.9	5.3
VII.	Circulatory system	0.5	2.2
VIII.	Respiratory system	7.1	20.2
IX.	Digestive system	2.8	17.2
X.	Genito-urinary	2.3	0.6
XI.	Deliveries	21.7	2.2
XII.	Skin & cellular tissue	4.1	0.2
XIII.	Bones & movement	0.3	0.1
XIV.	Congenital	0.1	0.6
XV.	Early infancy	0.2	2.7
XVI.	Symptoms, ill-defined	0.3	0.5
NXVII.	Accidents & violence	5.0	2.4
Supplementary categories		0.4	0
	TOTAL	100.0	100.0

Table XCI. Comparison of percentage morbidity and mortality amongst inpatient discharges from Tumutumu Hospital in 1944-1953.

FIGURE 94 Comparison of percentage morbidity and mortality amongst inpatients at Tumutumu.

We have already seen in Table XLI how infections dominate the picture of Kikuyu morbidity. The same is true of the mortality of South Nyeri District as we can see from Table XC. The following five categories include the majority of deaths in the Tumutumu series:

Infective & parasitic	37.5%
Respiratory disease	20.2%
Digestive disease	17.2%
Nutritional disease	6.4%
Nervous disease	5.3%
Total	86.6%

If we analyse these figures further we find that the incidence of infection is even higher than is suggested by the categories used: This analysis we may set out as follows:

Out of 307 deaths due to respiratory disease,
301 were due to pneumonia.

Out of 261 deaths due to digestive disease,
238 were due to gastro-enteritis.

Out of 82 deaths due to nervous disease,
70 were due to purulent meningitis.

These diseases are not included amongst the Infective diseases in the International Classification. If they were then they would make the mortality due to Infective disease about fifty-five per cent. of the total mortality.

Unfortunately the age and sex distribution of mortality for the South Nyeri District as a whole cannot be

given as the total figures are not available. We have however analysed the mortality figures for Tumutumu Hospital for the decade of this study and these are presented in the lists below. All diseases are included which were responsible for more than one death in any age or sex group. Maternity deaths are omitted.

Causes of death by sex & age group:

I. Ages under 1 year:

MALES	Deaths	FEMALES	Deaths
Gastro-enteritis	46	Bronchopneumonia	41
Bronchopneumonia	29	Gastro-enteritis	34
Kwashiorkor	21	Kwashiorkor	14
Tetanus	11	Purulent meningitis	12
Whooping cough	8	Whooping cough	10
Congenital syphilis	4	Tetanus	5
Non-pulmon. tuberculosis	3	Burns	5
Measles	1	Congenital syphilis	2
Burns	1	Measles	1
Total deaths	154	Total deaths	137
Percentage given above	80.5	Percentage given above	90.5

Infections and malnutrition account for almost all of the deaths in this age group in both sexes. The six cases of burns are presumably due to lack of attention to the infants in the house. These cases represent a fifty per cent. case fatality rate for burns in this age group for only twelve cases in all were admitted belonging to this age.

II. Age 1-4 years:

MALES	Deaths	FEMALES	Deaths
Bronchopneumonia	102	Bronchopneumonia	79
Gastro-enteritis	73	Gastro-enteritis	60
Whooping cough	25	Kwashiorkor	33
Kwashiorkor	21	Whooping cough	28
Purulent meningitis	13	Measles	19
Non-pulm. tuberculosis	11	Purulent meningitis	7
Burns	8	Tetanus	2
Measles	8	Non-pulm. tuberculosis	1
Tetanus	3	Burns	1
Lobar pneumonia	2		
Total deaths	317	Total deaths	240
Percentage given above	84.1	Percentage given above	95.7

The position in this age group is much the same as in the previous one. The majority of deaths are again due to the three diseases bronchopneumonia, gastro-enteritis and kwashiorkor. Whooping cough commonly ends as a fatal bronchopneumonia. Burns are commonest in this age group as we saw in Figure 91. Fifty-seven cases of burning were admitted to Tumutumu Hospital in this age group, but only nine died which gives a case fatality rate of 15.8 per cent. which is much lower than that found in the previous age group.

III. Age 5-14 years:

MALES	Deaths	FEMALES	Deaths
Pulmon. tuberculosis	24	Pulmon. tuberculosis	19
Tetanus	18	Tetanus	11
Typhoid fever	8	Gastro-enteritis	6
Purulent meningitis	7	Bronchopneumonia	6
Gastro-enteritis	6	Non-pulm. tuberculosis	4
Bronchopneumonia	5	Purulent meningitis	3
Whooping cough	4	Whooping cough	3
Lobar pneumonia	3	Typhoid fever	1
Measles	1	Measles	1
Relapsing fever	1	Relapsing fever	1
Total deaths	92	Total deaths	89
Percentage given above	83.7	Percentage given above	61.8

The majority of deaths in this age group result from pulmonary tuberculosis and tetanus. Bronchopneumonia and gastro-enteritis now decline in both incidence and fatality. Although the highest number of deaths in this age group are due to pulmonary tuberculosis, the highest fatality rate from this disease is found in the next age group, namely the 15-24 years group. The number of deaths from tetanus on the other hand reaches its maximum in this age group in which almost forty per cent. of the total number of deaths from the disease occur. It should be noted that infections constitute all the diseases listed in the above table. Malnutrition is no longer a direct cause of death as it was in the previous age groups.

IV. Age 15-24 years:

MALES	Deaths	FEMALES	Deaths
Pulmon. tuberculosis	46	Pulmon. tuberculosis	49
Non-pulm. tuberculosis	6	Relapsing fever	5
Typhoid fever	6	Non-pulm. tuberculosis	4
Lobar pneumonia	4	Typhoid fever	3
Wounds & injuries	3	Lobar pneumonia	2
Relapsing fever	1	Wounds & injuries	1
Total deaths	92	Total deaths	89
Percentage given above	71.8	Percentage given above	72.0

The main cause of death in both sexes in this age group is pulmonary tuberculosis, and it is in this age group that this disease shows its highest mortality. Deaths due to injury and wounding begin to appear in this age group, but the chief cause of death is still infective disease.

V. Age 25-34 years:

MALES	Deaths	FEMALES	Deaths
Pulmon. tuberculosis	21	Pulmon. tuberculosis	27
Non-pulmo tuberculosis	7	Non-pulm. tuberculosis	3
Lobar pneumonia	2	Lobar pneumonia	3
Fractures	2	Relapsing fever	2
		Bacillary dysentery	2
		Burns	2
		Fractures	1
Total deaths	54	Total deaths	82
Percentage given above	59.2	Percentage given above	48.7

Tuberculosis still maintains the lead as the cause of death in this age group as it did in the two previous age groups.

VI. Age 35-44 years:

MALES	Deaths	FEMALES	Deaths
Pulmonary tuberculosis	12	Pulmonary tuberculosis	12
Fractures	2		
Wounds	2		
Burns	2		
Total deaths	30	Total deaths	28
Percentage given above	60.0	Percentage given above	42.8

The number of deaths has declined greatly and those seen in this age group constitute only 3.8 per cent. of the whole series. Tuberculosis still maintains its lead. Injuries form a larger proportion of the causes of death amongst the males of this age group than in other age groups.

VII. Age 45-54 years:

MALES	Deaths	FEMALES	Deaths
Pulmonary tuberculosis	10	Pulmonary tuberculosis	2
Lobar pneumonia	3	Lobar pneumonia	1
Total deaths	20	Total deaths	14
Percentage given above	65.0	Percentage given above	21.5

VIII. Age 55-64 years:

MALES	Deaths	FEMALES	Deaths
Tetanus	6	Lobar pneumonia	1
Pulmonary tuberculosis	4		
Lobar pneumonia	3		
Total deaths	28	Total deaths	7
Percentage given above	46.5	Percentage given above	14.3

IX. Age 65-74 years:

MALES	Deaths	FEMALES	Deaths
Lobar pneumonia	3	Lobar pneumonia	5
Hemiplegia	1	Hemiplegia	1
Total deaths	10	Total deaths	9
Percentage given above	40.0	Percentage given above	66.6

X. Age over 74 years:

MALES	Deaths	FEMALES	Deaths
Senility	3	Senility	3
Lobar pneumonia	2		
Total deaths	9	Total deaths	5
Percentage given above	55.6	Percentage given above	60.0

In the last four age groups lobar pneumonia has been responsible for a number of deaths in each. If we take the groups together we find that lobar pneumonia is responsible for most of the deaths in Tumutumu Hospital patients over the age of fifty. These figures refer to a ten year period during which sulphonamides and then penicillin were available

for treatment of this disease. This suggests that age is still an important factor in the prognosis of lobar pneumonia amongst hospital patients in South Nyeri District.

Finally we come to a consideration of the most fatal diseases seen in hospital practice amongst the Kikuyu of South Nyeri District.

Table XCIV lists these diseases in the order of the number of deaths they caused. These figures are derived from Table LXXXIX and refer to the three hospitals of the District. This table gives the total number of deaths due to each disease irrespective of the case fatality of the disease. These are the "killing diseases" of hospital practice of South Nyeri District.

In Table XCV, on the other hand, is given a list of fatal diseases in order of their case fatality rate. These cases were seen at Tumutumu and so are less representative of the whole district than the figures given in Table XCIV. These are the diseases with the worst prognosis. They did not necessarily produce the greatest number of deaths since their prevalence was not as great as other diseases which, although they had a lower fatality rate, yet produced more deaths because they showed a greater prevalence. For the purposes of compiling Table XCV diseases of which under twenty cases were seen have been excluded.

	TOTAL DEATHS	PERCENTAGE OF GRAND TOTAL
Bronchopneumonia	542	15.3
Tuberculosis(all forms)	512	14.5
Gastro-enteritis	402	11.3
Purulent meningitis	184	5.2
Lobar pneumonia	178	5.0
Kwashiorkor	167	4.7
Tetanus	157	4.4
Typhoid fever	129	3.7
Malaria	128	3.7
Whooping cough	106	3.0
Childbirth	93	2.6
Anthrax	57	1.6
Burns	56	1.6
Immaturity	49	1.4
Relapsing fever	48	1.4
Malignant neoplasms	46	1.3
Intestinal obstruction	43	1.2
Cirrhosis of liver	377	1.1
Acute nephritis	36	1.0
Bacillary dysentery	35	1.0
TOTAL	3,005	86.0

Table XCIV. Fatal diseases classified according to total number of deaths they caused in South Nyeri District.

DISEASE	CASES	DEATHS	CASE FATALITY PER CENT
Rheumatic heart disease	23	16	69.5
Congestive heart failure	22	15	68.2
Tetanus	137	73	53.3
Purulent meningitis	137	70	51.1
Pulmonary tuberculosis	559	243	43.5
Tuberculosis(all forms)	809	291	36.0
Carcinoma of liver	23	8	35.1
Typhoid fever	117	41	35.1
Gastro-enteritis	720	238	33.2
Kwashiorkor	331	86	26.0
Bronchopneumonia	1,110	265	23.8
Burns	124	21	16.7
Whooping cough	481	78	16.2
Measles	215	23	10.7
Bacillary dysentery	153	10	6.5
Lobar pneumonia	560	36	6.4
Anthrax	113	7	6.2
Relapsing fever	338	15	4.5

Table XCV. Case fatality rates of fatal diseases in Tumutumu Hospital 1944 to 1953.

CONCLUSION.

CONCLUSION

Any attempt to assess the health of an underdeveloped community such as the Kikuyu is hampered by the lack of reliable vital statistics. We have seen how the Health Office of South Nyeri District made a pioneer effort to collect these, but this effort ceased before any degree of accuracy had been reached. It is to be hoped that the opportunity of compiling more accurate statistics afforded by the new "villagisation" scheme will not be lost. In the meantime we must make what use we can of the figures derived from the practice of curative medicine in an endeavour to discover the nature and incidence of disease amongst the Kikuyu people. This we have tried to do in this study. It remains now to make some general observations on the health and disease of the population of Northern Kikuyuland. Firm conclusions are not possible and any observations must be regarded as tentative only.

The first observation we may make is that our study has shown that the Kikuyu people have come to recognise the benefits of Western medicine. The fact that every year one out of every two people voluntarily consult the medical services is an index of the confidence they have come to place in those medical services over the fifty years of their operation in Kikuyuland.

Then, if we are to judge from hospital inpatient experience, the Kikuyu population appears to be a young population. We deduce this from the low numbers of the older age groups amongst hospital inpatients(Table XXXIV)

and the low mortality rate for these groups(Table LXXXVII). The Kikuyu people appear to die at a younger age and this is probably related to the high incidence of infectious disease amongst them. Thus infectious disease accounts for over fifty per cent. of all hospital inpatient admissions, and for over fifty per cent. of the deaths of patients in hospital. Infectious disease, especially bronchopneumonia and gastro-enteritis, is particularly prevalent amongst children under five years of age and it is in this age group that the greatest percentage mortality occurs in hospital inpatients(Table LXXXVII).

In spite of this high mortality in childhood the Kikuyu tribe is increasing, and increasing at a rate of about two per cent. annually according to competent observers. This implies a high birth-rate, but we are not able to determine what the true birth-rate is. We saw on page 32 that it was believed to be in the region of forty-five per thousand, which is very high and must be near the maximum possible for the human species.

The Kikuyu tribe in common with the rest of the indigenous people of Africa is in a state of transition. it is moving rapidly along the road which leads to development and civilisation. We have had occasion to mention several aspects of this changing situation for it has a definite influence on the pattern of disease amongst the African peoples. Some infections such as anthrax and relapsing fever appear to be decreasing in incidence. Others are tending to become more prevalent.

This may be illustrated by the increased incidence of typhoid fever and whooping cough since the Kikuyu people were concentrated in the new villages. Other diseases are showing a different type of incidence. We may take tapeworm infestation as an illustration of this. In the old tribal life, women were not permitted to eat meat, but to-day they make up almost thirty per cent. of the cases infested with the beef tapeworm. Then there are reports of the increasing occurrence of those diseases which have been associated with civilisation, and we have found three cases of peptic ulcer in the Tumutumu Hospital series. It is possible that others were missed, and that still more will come to light in the future.

We saw in Table XII that there are several diseases which appear to be peculiar to the African. It is not yet clear whether the incidence of these diseases is racially determined or merely due to the African environment. It is easy to understand how disorders of pigmented tissues such as melanoma of the skin are the result of the African's adaptation of his skin to tropical sunlight. But there are a few lesions which do not appear to be explicable on environmental grounds and which are most often or only seen in African people. Such are the lesions of ainhum, onyalai, sickle-cell disease and the fibroplastic diathesis. The fact that the number of these lesions is so few suggests that they are not due to any really fundamental racial difference which would be expected

to reveal itself in a greater difference in pathological response than is revealed by these lesions. We do not yet have enough knowledge of these diseases and their causation to be dogmatic, but in general it appears probable that they will finally be found to be due to environmental conditions rather than genetic.

There can be no doubt that environmental factors do play a major part in determining the incidence of disease in Kikuyu country. We discussed these factors at some length in Section III, and now add a few more notes about them in the light of later sections.

So far as the climate was concerned no clear-cut relationship with morbidity or mortality was found. The annual sickness consultation rate showed an inverse relationship to the mean annual temperature with a coefficient of correlation of-0.53, but this was not seen in the monthly data. Also certain diseases showed a definite relationship to the dry or the wet season (see Table XLV). In general, however, no clear relationship between climate and sickness was found, and it is probable that the influence of climate on the health of the people is indirect rather than direct.

The state of sanitation amongst the Kikuyu people, on the other hand, has a very direct influence on their sicknesses. Many of the common infections seen amongst them could be controlled and even eliminated by good personal and environmental hygiene. Much is being done to spread the knowledge of good hygiene through school

and health centre, and there is no doubt that slow improvement is taking place. One example of the influence of health education is the increasing provision and use of the pit latrine in homesteads and villages. The level of sanitation in the community reflects the social and economic progress of the people and as the standard of living rises so sanitation will improve and the diseases resulting from bad sanitation will diminish in incidence.

The diet of the Kikuyu is deficient in several essential food factors if we compare it with the dietetic standards accepted in European countries. Yet in our study of the diseases of Kikuyuland we found evidence of only one specific deficiency disease, that of kwashiorkor. This suggests that the Kikuyu have become adapted to intakes of such factors as fat, calcium and niacin much lower than those thought to be required for man. It may be that the price they have paid for this adaptation is shortness of stature and low reserves with which to meet emergency demands, but the striking fact is that they have been able to avoid showing specific states of deficiency apart from that of kwashiorkor.

The main task before medicine in Africa to-day is preventive rather than curative. Curative services there must be, but the emphasis must be on prevention for so many of the diseases of Africa are preventable. The two main methods of preventive medicine are the collection of statistics and the dissemination of knowledge. We

need vital statistics that we might know what is happening to the population and where the main attack of disease is occurring. We need knowledge of the causation and transmission of disease that we might be able to show to the people how disease might be prevented. We have few statistics so far, but we have much knowledge of the prevention of disease by which we can educate the people in the simple rules of health and so prevent much of the disease which brings so much suffering and death to African peoples.

The problem of disease is never a purely medical problem, and nowhere is this more evident than in Africa to-day. For its prevention and control we must enlist the aid of the agriculturalist, the veterinarian and the economist. Only in this way will medicine become more truly preventive than it is to-day, and only in this way will medicine be able to help Africa along the road of economic and social progress, and to assist its peoples to make their proper contribution to the life and thought of the world.

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For the preparation of this thesis material was obtained from the following sources:

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1. Annual reports of the District Commissioner(1944-1953).
2. Census return for South Nyeri District(1948).

MEDICAL DEPARTMENT RECORDS, SOUTH NYERI DISTRICT:

1. Annual reports of the Medical Officer(1944-1953).
2. Annual reports of the Health Officer(1944-1953).
3. Monthly reports of the Medical Officer(1944-1953).
4. Monthly reports of the Health Officer(1944-1953).
   (Both series of monthly reports are incomplete)
5. Weekly return of notifiable infectious diseases for South Nyeri District(1947-1953).
6. Register of notifiable infectious disease in South Nyeri District(Only available for 1/12/50 to 31/12/53).

TUMUTUMU HOSPITAL RECORDS:

1. Annual reports(1918-1953). Series incomplete in early years.
2. Case records of inpatient discharges(1944-1953).
3. Outpatient record books from January 1951 to December 1953.
4. Hospital correspondence files(1918-1953).

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1. Monthly statistical return for inpatients(1946-1953).
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3. Monthly death returns of the hospital(1946-1953).

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1. Annual reports of the Director of Medical Services of Kenya(1911-1953).
2. Annual and monthly summaries of climatic data of South Nyeri District collected by the East African Meteorological Service, Nairobi.

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